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ABSTRACT

Israel's current higher education system and projections for the future are examined. Higher education planning is also discussed, with attention to the establishment of the Planning and Grants Committee, basic data for system planning, and problems requiring decisions. Information on institutions, students, and budgets is provided, including fields of study offered at seven universities/institutes, enrollments by institution, number of graduates annually from 1974 through 1982, numbers of staff employed, and budget allocations by type of expenditure. Buildings and equipment are also covered, including: building floor-space at universities by usage, scientific equipment, computers, and libraries. The number of full-time academic staff at seven institutions by major responsibility, and student teacher ratios by institution are identified. Student enrollment projections for 1988 are presented, by degree level and fields of study. Also included are supply and demand forecasts for academically qualified personnel and forecasts for replacement and retirement for academic staff. Projections for higher education for 1983-1988, as well as for 1995, are included. Appendices include data on the 1982 budget, geographic considerations, and forecasts for physicians, engineers, and technical personnel. (SW)

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The Council for Higher Education
The Planning and Grants Committee

The Higher Education System in Israel

Guidelines on the Development of the System and its Planning for 1988 with a First Glance at 1995

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Jerusalem, 1983

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The Planning and Grants Committee

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In my preface to this brochure, written in 1983, I made these remarks:
"Cutting down on the funds allocated to the universitites affects not only them. Damage is done primarily to all those national enterprises which cannot exist without long-term fundamental work in institutions of higher education."

Since these remarks were made the plight of higher education has not improved. On the contrary, the higher education budget has undergone further drastic cuts.

What is at stake is not only the future of higher education and scientific research but the future of the State itself. For Israel cannot develop and prosper if she does not stand in the forefront of human knowledge in all areas of science and culture.

It is my hope that the government will speedily realize the danger to the State resulting from these cuts at a time when the civilized world is experiencing a revolution no less important or far-reaching than the industrial revolution in its day.

July, 1984 Haim Harari

The Council for Higher Education

The Council for Higher Education is "the State institution charged with higher education in Israel".

The Council has a membership of 25 including the Minister of Education and Culture who is ex-officio its chairman. At least two thirds of its members are academics of standing recommended by the Minister after consultation with the institutions of higher education. The members of the Council are appointed by the President of the State for a period of five years.

The powers of the Council include the following:

a. to recommend to the government the granting of a permit to open an institution of higher education, which is the first step in the process of academization and subsequent accreditation;

b. to recommend to the government the granting of partial or full accreditation to an institution of higher education;

c. to authorize accredited institutions to award academic degrees.

The Planning and Grants Committee — PGC

The PGC is the planning and executive arm of the Council for Higher Education.

The PGC has a membership of six including its chairman, who is ex-officio a member of the Council. Four of the members including the chairman are academics of standing; the other two generally come from the economic life of the country.

The terms of reference of the PGC include the following:

a. to plan higher education;
b. to submit to the government the global ordinary and development budget proposals;
c. to decide upon the budgets, ordinary and development, to be allocated by the PGC to each institution of higher education;
d. to ensure that budgets are balanced;
e. to encourage inter-institution cooperation;
f. to encourage basic research.

The Planning and Grants Committee (PGC)

Committee Members:
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Prof. Yehudith Birk
Mr. Itzhak Mann
Mr. Simha Sorokcr
Prof. Daniel Sperber
Prof.Gabriel Warburg

Administration:

Mr. Gedalia Yaakoby — Director-General
Miss Ruth Silberberg — Deputy Director-General and i/c Development
Dr. Meir Zadok —i/c Planning
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Mrs. Techia Karcz — i/c Ordinary Budgets
Mr. Uriel Turniansky — i/c Data and Statistics
Miss Pirhiya Bahar — Assistant to the Secretary-General of the Council for Higher Education and the PGC

Mr. Shmuel Bendor — Consultant

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Preface

The State of Israel and the Jewish People must above all rely upon their own spiritual, cultural and scientific resources. These resources must have a broad base of education and research, capped by the system of higher education in Israel. The image of our society and economy a decade or two from now will be fashioned largely by present activities in all spheres of study and research at our universities.

It must be remembered that the higher education system directly or indirectly touches upon almost every matter of concern to the State. The development of sophisticated industries depends on university training of engineers and scientists and on pure and applied research, often evolving within the higher education system a number of years before reaching industry. An educational system is nurtured by research in education and new study programs, but principally by teachers graduating at institutions of higher education or engaging in supplementary studies there. The world of art and culture is intimately tied to the institutions of higher education and their departments of literature, music, plastic arts, design, theater and the like. Nearly all basic scientific, and the major part of applied, research in Israel is conducted at universities—from nuclear physics to a study of Jewish mysticism, from advanced agricultural research to a study of Mediterranean peoples. Progress in Israel in advanced medicine or progressive agriculture would be inconceivable without university schools of medicine and agriculture. Institutions of higher education also make valuable contributions to other systems in the country, from defense to the judiciary and the lawcourts.

Cutting down on the funds allocated to the universities affects not only them. Damage is done primarily to all those national enterprises which cannot exist without long-term fundamental work at institutions of higher education within the system of higher education. The damage done is mostly felt only when it is already hard to repair. Obsolete scientific apparatus means scientific progress retarded today, backward technology and

industry tomorrow. Losing a generation of young academics and researchers affects our prospects of maintaining high intellectual and technological standards in years to come. A major test for the country is the degree of readiness to grant higher education the means needed to fulfill its tasks. The higher education system is measured by its ability to exploit such means in the best and most efficient manner.

The material presented in this publication is an attempt to answer a number of questions — How will higher education in Israel look at the end of the eighties? What steps are required of the government and the universities to ensure the welfare of higher education? What lines of development are prescribed by the needs of society and the economy? What problems must we tackle over the next few years to allow us to be ready for the nineties?

To a part of the problems we present clearcut answers backed by decisions of the Council for Higher Education or the PGC. On other topics we propose guidelines evolved in discussions between the Council, the PGC and the universities, without resulting in formal decisions. On some subjects we merely suggest a number of possible lines of action; on others just questions which require an answer.

This document inevitably leads to two clearcut conclusions — one concerning policies of the government of Israel, the other action in the higher education system.

The government must hold urgent, exhaustive discussions on the future of higher education in Israel, aimed at progressive increases in the means the country allocates to the system. Higher education and scientific research in Israel are slowly slipping into a state of serious crisis, which in not very many years will in various ways badly damage the fabric of our society and economy. The collapse can still be halted.

The higher education establishment will have to make even greater efforts to raise academic standards, exercise self-restraint, avoid unnecessary duplication, strive for economy and greater efficiency, and more directly contribute in solving social and economic problems, beyond routine duties of teaching and research. Universities must wholeheartedly uphold the tenet:

"Practice what you preach".

Before preparing this publication, we learned a great deal from discussions with the heads of all the universities. We sought the

advice of several past members of the PGC, and I take this opportunity to express my gratitude to them. All the members of the PGC and each one of the professional and administrative staff fully shared in preparing this document. Special thanks are due to Ruth Silberberg and Meir Zadok who bore the brunt of the burden, to Uriel Turniansky for his help with the data and statistics, and to Esther Regev for her help in all technical matters.

Haim Harari

Jerusalem, 1983

Principal Conclusions

In this document the Planning and Grants Committee of the Council for Higher Education presents guidelines for planning the higher education system in the coming five years, 1983—1988 with a first glance towards 1995. The document contains: detailed figures on developments in the system over the past decade and conditions today; forecasts of student numbers and the country's needs for academically qualified manpower in the various professions; conclusions; decisions and lines of action over the coming five years.

The following are the principal findings:

1. **In the past decade students at universities grew in numbers by 30%. Over the same period the number of academic staff posts decreased by 3%, technical and administrative personnel by 1%. Expenditure other than salaries fell 26% in real terms. The share of higher education in the national budget (excluding defense and debt repayments) fell by some 44%.**

2. The ratio of students to teachers was satisfactory at the end of the seventies but deteriorated in recent years, reaching limits which give cause for concern.

3. Worst hit were funds required for the purchase of scientific equipment, libraries, basic research and maintenance. In all these spheres the system has crossed every acceptable "red line".

4. The amount of building floor-space is on the average satisfactory. With this there are shortfalls in a number of spheres at several institutions, while others have reserves allowing for the absorption of additional students and the extension of various activities.

5. **From existing figures and forecasts the State of Israel will need no additional universities up to the end of the eighties.**

All objectives in study and research can be handled by existing universities.

6. In 1988 there will be some 70,000 students at the universities, an increase of 12% over 1983. All the students expected in 1988 can be absorbed by the universities existing today.

7. It would be desirable to reduce the growth rate of student numbers at Bar-Ilan and Tel-Aviv Universities on nearing 1988. An increased rate of growth would be desirable at the Hebrew University of Jerusalem, the Ben-Gurion University of the Negev, and to some degree also the Technion in Haifa.

8. Faculties existing at the universities today will fill the needs of the country and its economy until 1988; forecasts indicate there should be no need for any new faculties. There is room for additional units at the departmental level and below. Some of these already existing can be expanded to include studies for higher degrees.

9. Undergraduate curricula at universities should be reviewed. Among other things an examination is needed of possibilities for broadening the framework of general and inter-disciplinary studies, and examination of the length of time required to study for the degree of bachelor, the use of technologically advanced teaching aids and the study framework for older students reaching universities for a second round of studies.

10. Equilibrium is foreseen over the next five years of supply and demand in general for academically qualified manpower.

11. In the fields of electrical engineering, computers and dentistry a shortage of university graduates is foreseen, and in medicine a surplus. In most other fields a balance can apparently be expected.

12. The country's needs for academically qualified manpower in the fields of agriculture, law and the training of teachers for junior and senior high schools should be examined. In these fields forecasts have yet to be made.

13. Engineering and scientific professions needed for high-technology industries must have the highest priority in the higher education system over the coming five years. Heading the list are electronics, computers, robotics, electro-optics,

bio-technology and genetic engineering. Growth-rates for aeronautical and nuclear engineering depend on the progress of major national projects (the "Lavie" airplane and a nuclear power station). The number of students,academic and technical staff, scientific equipment, computers and building floor-space must be considerably expanded in faculties dealing with electronics and computers.

14. In the science faculties — except for computer sciences — all the universities have the capacity to admit additional students without any further investment in buildings and academic staff.

15. Up to 1988, the bulk of university construction enjoying government subsidies will be devoted to improving conditions at the faculties of humanities and social sciences at Tel-Aviv and Bar-Ilan Universities, filling minimal needs existing today. Construction at all other institutions will be on a restricted scale. Among other buildings due for PGC budgetary aid are: electrical engineering at Beer-Sheba and Tel-Aviv, dentistry at Tel-Aviv and nuclear engineerng at the Technion, Fully financed by donations, student hostels will be enlarged, mainly at Beer-Sheba, but also at Bar-Ilan and Haifa Universities and the Technion.

16. There should be increased inter-university cooperation by the erection and establishment of inter-university centers dealing with topics such as: computers,uniform entrance exams, inter-library cooperation, joint purchasing, the students tutorial project (Perah),* pre-academic preparatory courses and others.

17. No effort must be spared to increase the number of Jewish students from abroad coming to study at our universities.

18. Pre-academic preparatory courses must be expanded, to allow access to university studies to the widest possible range of the population.

19. Academic staff at universities has to be increased by 12—20% by 1988 so as to maintain the maximum permissible ratio of

*Students who volunteer to serve 4 hours a week as tutors to pupils requiring special coaching in schools designated by the Ministry of Education and Culture are eligible for scholarships amounting to 60% of their tuition fees.

students to teachers. The need to increase administrative and technical staff with the increase in numbers of students and teachers has to be examined. The ratio of students to technical and administrative staff rose from 5:1 to 8:1 over the past decade.

20. In view of the serious reductions in the past in funds for the purchase of scientific equipment, for libraries, and for campus maintenance, non-salary expenditure should by 1988 be restored at least to its level in real terms ten years ago. It should be raised to about 30% of the budgets of the universities.

21. Funds earmarked for basic research at universities should be increased by the augmentation of government research funds (the Basic Research Fund and the United States-Israel Bi-National Science Foundation — BSF), as well as increasing internal university funds allotted for this purpose.

22. **To meet these requirements budget allocations for higher education must be increased in real terms by at least 3% in each of the coming five years and preferrably 6% a year, assuming that salaries in real terms will remain unchanged. An increase of 3% a year in real terms will prevent further deterioration but will not improve the situation.**

23. If this minimum increase fails to materialize, the universities will be unable to accept all the suitable students seeking admission. This will adversely affect industry and defense, as well as social progress in those sectors of the population which in recent years began to enter the field of higher education. In either case the damage possible would be more than the country can afford.

24. Government development budgets required for university building programs over the next five years can remain at present levels.

25. **We estimate that by 1995, there will be some 85,000 students. Preparation for significant expansion and large investments in existing universities or the establishment of new institutions in the early nineties are thus essential. These matters must be decided within the next two or three years.**

Chapter 1: Planning Higher Education in Israel

Evolution of the Higher Education System

The history of the higher education system in Israel is inextricably entwined in that of the State of Israel. The first institutions of university level were established by the "state in the making". During the period of mass immigration of the fifties the three veteran institutions — the Hebrew University, the Technion and the Weizmann Institute — began to expand and became firmly established. Later on, the end of the fifties and sixties saw the establishment in turn of Bar-Ilan, Tel-Aviv, Haifa and Ben-Gurion Universities. Those were times of growth and expansion, enthusiasm and vision, without government planning or centralized supervision. Numbers of students and lecturers, floor-space and the scope of research in those years grew rapidly.

Many of today's excellent academic centers were founded in those "years of plenty". Some of the less desirable facets of the system were also created in that period. **Though centralized planning was non-existent, satisfactory geographic and professional equilibrium did develop among the various universities.**

The Yom Kippur War found the higher education system at the peak of expansion, with far-reaching building programs and large monetary deficits resulting from the rapid growth. The war and the economic and budgetary difficulties which came in its wake led the system into a long period of budget cuts, declining activities and a halt to building. Most fortunately, the period of retrenchment was forced on the universities only after physical and academic foundations had been laid and which would serve the country's needs until the end of the eighties. Thanks only to these, the higher education system is still functioning and supplies economic and social needs, training academically qualified manpower and conducting scientific research.

The Establishment of the Planning and Grants Committee

Soon after the Yom Kippur War, but not connected with it, the late Yigal Allon, then Minister of Education and Culture, decided to establish the Planning and Grants Committee (PGC) of the Council for Higher Education. For the first time in this country, a body was established for planning the university system and apportioning all government funds allocated to it. Over the ten years since the PGC was established and despite unending budget cuts, all the past deficits have been wiped out, and new deficits prevented. Thus the system entered into an ordered framework of budgeting and control.

Debit and Credit over the Past Decade

Among the achievements of the higher education system during the past decade we may count the growth in student numbers by about 30%, the establishment of Everyman's (Open) University, the School of Medicine in the Negev, the School of Dentistry in Tel-Aviv, the Institute for Desert Research at Sde Boker, considerable expansion in the scope of applied research at the universities, expansion of study and research in essential fields such as computer sciences and others. On the debit side mention must be made of the reduction by some 8% in manpower serving the system, the reduced extent of basic research, rapid deterioration in the state of libraries, scientific equipment and campus maintenance, with a fall of some 40% in the portion of the government's budget allocated to higher education.

Discussions on Planning the System

Before the Planning and Grants Committee (PGC) was set up, there was no body in the country concerned with planning higher education. During the first years of its existence most of the efforts of the PGC were directed at arranging the system's budgets, and foundations were laid for data banks of statistical information concerning the universities. In those years the base for overall planning was formed. In the years 1979-1980 the PGC made a number of decisions which established the methods of laying down guidelines in planning for the higher education system. Among these was the decision to instigate inquiries into the supply and demand of academically qualified manpower in certain professions; universities were asked to submit plans for physical and academic development; a comprehensive survey was made of academic and administrative manpower employed at the universities; forecasts were requested of student numbers for the coming years.

Using all the information accumulated, the PGC in 1982 prepared for exhaustive discussions on planning the Higher Education system for the coming years. Preliminary talks were held by the members of the PGC's professional team and continued at regular PGC sessions, leading to joint discussion with each one of the universities and winding up for final summary by the PGC. The present document summarizes the conclusions drawn and decisions made by the PGC. It is also based on a series of decisions passed by the Council for Higher Education in various consultations.

Target Years for Planning Activities

Two target years were chosen as objectives for planning work. The first is 1988. There is no difficulty involved in outlining the 1988 situation in the higher education system. Most of the undergraduates of 1988 are now in their 11th or 12th school-year or in the army, and their numbers are known approximately. No far-reaching changes are to be expected in the size of universities or the structure of their components. Hence the PGC was ready to go into relatively great details in its forecasts for 1988.

The other target year is 1995. For this year, any forecast is hazardous and chances are high that it will be found wrong. Students of 1995 are today in their 4th or 5th year at school and some of the lecturers and senior lecturers of 1995 are today still at their under- or post-graduate studies. With all that, we do have certain information indicating thought-provoking trends, and we must begin to prepare for them in the next few years.

Limitations in Planning

The system of higher education must supply the needs of the state and its economy and society for academically qualified manpower in all professions. The system must also fulfill the individual's desire for the broadest and most profound education possible and contribute to the cultural infrastructure of society, bridge disparities between diverse strata of society and further educational systems at all levels. In a democratic state many limitations are imposed on the planners. The State is not able or willing to dictate to its citizens their field of learning or the place for their academic studies. With all that, the various governmental bodies are obliged to aim for maximal exploitaton of all resources available to higher education. With this in view, the granting of preference for certain spheres of study and research, or for universities in particular areas, is legitimate and even indispensable.

Some will see the higher education system as an instrument of government, whose duty is to serve the economy. Others see academic studies as learning for its own sake. Planning policies must find the right balance between these two points of view and direct the system accordingly.

In any attempt to plan the higher education system it must be borne in mind that the best growth is based on the ideas of people who are part of the system and that initiated by "fanatics" who are first to become aware of fresh needs in many spheres. Ideal planning must allow market forces and individual initiatives to make their contributions. Nevertheless an overall view of the system allows a more correct allocation of means available and appropriate reactions to legitimate pressures exerted from within the system.

Basic Data for System Planning

The following parameters supply the basic data for any planning activities in the higher education system:

National Requirements for Academically Qualified Manpower. An essential base for planning higher education includes estimates and forecasts of nation-wide requirements for academically qualified manpower in general and those in specific professions in particular. Forecasts are especially important in professions where the number of those engaged in them is directly dependent on the number of students graduating. These professions include medicine, dentistry, engineering in all its forms, research and development in the sciences, social work, agriculture and others. Less pronounced are the humanities and social sciences, law, management and the arts. In these fields the connection between the subject studied and the graduate's occupation is less pronounced.

Student Potential. We assume there will be no far-reaching policy changes over the next few years at the Ministry of Education and Culture concerning matriculation certificates, and that there will be no significant change among recipients of matriculation certificates in their desire for academic studies. The student potential will therefore be determined mainly by forecasts concerning successful matriculants. In a rapidly developing technological society there is a growing need for additional academic training and additional and refresher studies for those already holding academic degrees. This sector is likely to resume university studies ten to twenty

years after completing the first round of studies. This sector is likely to swell the student potential of the nineties.

Admission Policy. Ever since the establishment of the State all governments in Israel adopted a policy of allowing every citizen interested in higher education to obtain it if his qualifications are found acceptable. Some countries have a more selective approach, others embrace more "generous" admission policies. As long as there is reasonable agreement between numbers matriculating and the needs of the economy and society for workers with academic training, there is no need for a change in present policy.

Academization of New Professions. We assume that in coming years the trend towards academization will continue in professions which today are wholly or in part based on post-secondary but not academic training. This includes professions such as practical (non academic) engineers, school teachers, para-medical professions, and others. Separate policies must be determined for each one of these. For a number of professions academization is desirable. For others it should be opposed. It may be assumed that the process of academization will advance at a rate determined by overall planning policy, and will contribute somewhat to the number of students at institutions of higher education.

Student Numbers. In view of the above assumptions we have to prepare forecasts for the number of students expected in 1988 and in 1995 and try to classify these students by their choice of major fields of study and the degree levels sought.

Academic, Administrative and Technical Staff. For system planning a snapshot view is needed of the present situation concerning the size of academic staff at the various universities and their distribution by fields of study and research, professional grades and ages. Here forecasts of retirement of members of the academic staff are of great importance. We must also have such data for administrative and technical staff.

Buildings. Effective floor-space at the different universities with distribution by usage is an important factor required as the basis for any planning; it must influence building programs for coming years and admission policy for additional students in one or other faculty or university.

Geographic Distribution. Institutions of higher education must fill population needs, with due allowance made for existing geographic distribution on the one hand and the government's policy of population dispersal on the other.

Problems Demanding Decisions

Starting with all the above factors we must draw an outline picture of the desired position in higher education for 1988 and 1995. A number of problems must be decided immediately. Others require that discussions and inquiries be started now to allow decisions to be taken after their completion. For the years up to 1988 the following questions must be answered:

New Universities and Faculties. Is there any need in the coming years to found new universities? Are new non-university institutions of higher education needed? Should new faculties be opened in existing universities? Is there a need for new units at departmental or other levels? Is there a need for significant expansion or cutting back, perhaps even closure, of existing departments or courses? Should the system of non-university institutions of higher education and academic courses in regional colleges be expanded?

Student Admission Policies. Should the policy of admission of new students to universities be changed? Will the system be able to continue to maintain the principle of allowing every student academically qualified for study to do so at a university in Israel, or will budgetary pressures impose a limitation on the number of students by raising entrance requirements?

Directing Students. Is there any need to regulate the growth in student numbers at the universities? Is it possible to create a system of incentives which would encourage students to go to universities whose infrastructure is not fully utilized, rather than to more "congested" ones? Can and must the number of students in different fields of study be influenced? What means are suitable for this purpose?

Academic Staff. Need the numbers of academic staff at the universities be increased? Are there growing indications of special difficulties in recruitment of academic staff in specific professions or fields? Can the quality of teaching and research in the universities be maintained or even improved with increasing numbers of students and expanding infrastructure?

Research. Should present proportions of the volume of research between departments be maintained? Should the present ratio of basic to applied research be changed? Should the State contribution in direct grants for research at universities be increased? Is there a need for special encouragement of the specific fields of research important to different sectors in the country (industry, defense, medicine, agriculture, energy, education, social work etc.)?

Physical Development. What new buildings does the system need in the coming years? Which buildings must be constructed with State support, and which buildings may be built only if fully financed by donations or sources from abroad?

Resources. What are the minimum means required to execute all those programs considered essential for developing the economy, training manpower vital for the country, maintaining the standards and scope of scientific research and upholding the country's social fabric? Can tuition fees be raised further in real terms? Can more be done to increase income from donations? Can the State increase its share in awards to university researchers? What amounts of direct government allocations to higher education are mandatory for the execution of essential programs?

Contents of Brochure

This brochure contains 5 chapters and 4 appendices.

After the introductory chapter, chapter 2 is an analysis of developments in recent years in the higher education system and a picture of the situation at present concerning the various institutions — fields of study, budgets, buildings, manpower, equipment etc. Chapter 3 is a brief review of forecasts concerning student numbers, supply and demand of academic manpower in different professions and a retirement time-table for the academic staff. Chapter 4 presents our conclusions, decisions and guidelines for action deriving from these data and concerning the higher education system, for 1983—1988. In Chapter 5 we present the problems requiring consideration and preparedness before 1995. A summary of our conclusions and decisions is given at the beginning of this booklet The appendices give details of data forecasts which served as a basis for this report. In preparing the booklet we endeavoured to make each of the principal chapters — position today; forecasts; conclusions and decisions — readable on their own. Accordingly we had to refer to some topics in

several places and at times even to repeat ourselves, and for this we ask the reader's indulgence.

Of the two central tasks of the universities — teaching and research — the lion's share of this booklet is devoted to teaching. This is not to detract in the slightest from the importance of research. Scientific research is by nature unamenable to precise planning. Training processes of academic workers are by nature directly affected by the needs of society and the economy, which is the reason for the planner's concern with them.

Chapter 2: The Higher Education System Today

1. Basic Information (Institutions, Students, Budgets)

The higher education system in Israel in 1983 consists of: seven institutions at university level, Everyman's (Open) University, eight non-university institutions of higher education and three in the process of academization.

List of Institutions of Higher Education

Institutions where academic studies are held may be divided into a number of groups: the first group consists of the seven universities with which the PGC has dealt from the day it was set up, namely:

- **The Hebrew University of Jerusalem;**
- **Technion — Israel Institute of Technology;**
- **Tel-Aviv University;**
- **Bar-Ilan University;**
- **The University of Haifa**
- **Ben-Gurion University of the Negev;**
- **The Weizmann Institute of Science.**

An additional university which in 1980 was accredited by the Council for Higher Education and authorized to award the degree of bachelor is:

- **Everyman's (Open) University.**

The second group consists of institutions of higher education which are not universities or teacher training colleges. These institutions are also under the aegis of the PGC. This group consists of:

- **Jerusalem Rubin Academy of Music and Dance;**
- **Bezalel — Academy of Arts and Design, Jerusalem;**
- **Jerusalem College of Technology;**

- **The Shenkar College of Textile Technology and Fashion;**
- **Ruppin Institute of Agriculture — Course in Economics and Administration in the Cooperative (Kibbutz) Economy;**
- **The College of Administration, in Tel-Aviv — Course in Business Administration (in the process of academization).**

The third group consists of a number of academic courses in teacher training institutions, accredited by the Council for Higher Education. These institutions are financed by the Ministry of Education and Culture. The Council for Higher Education set up a special permanent committee to deal with them. The institutions and courses are:

- **The David Yellin Teachers College — Course for Training of Teachers for Junior High Schools;**
- **Jerusalem College for Women;**
- **Beit-Berl Teachers Training College — Courses in Education and Training of Teachers for Junior High School and Non-Formal Education);**
- **The Levinsky Teachers College (in the process of academization);**
- **The Zinman College of Physical Education at the Wingate Institute (in the process of academization).**

The fourth group consists of institutions, such as regional colleges, which provide certain academic courses under the academic supervision of a university. Students in such courses are considered as students of the university; teachers are appointed and degrees awarded by the university. These are not institutions of higher education but they must be taken into account in any overall plan for the system. The courses of the regional colleges are financed by the Ministry of Education and Culture and by various regional authorities. The Council for Higher Education has appointed a special committee to deal with academic courses at regional colleges.

Fields of Study

Table No. 1 summarizes fields of study at the various institutions. It also includes the non-university institutions of higher education.

Numbers

The number of students at the seven university-level institutions reached some 62,500 in 1983, an increase of 30% over the last ten years. Some 62% of the students are studying humanities, social sciences and law, some 23% natural sciences, agriculture and medicine, and some 15% engineering. Some 73% are studying for

Table 1. Fields of Study (Faculties) at Institutions of Higher Education

(Faculty)	Hebrew University	Technion	Tel-Aviv University	Bar-Ilan University	Haifa University	Ben-Gurion University	Weizmann Institute	Everyman's University	Non-university Institutions
Law	+		+	+					
Social Sciences	+	+	+[3]	+	+	+[6]		+	[7]
Humanities	+		+	+	+	+[6]		+	
Arts	[1]		+		[1]				[8]
Social Work	+		+	+	+	+[6]			
Teacher Training	+	+	+	+	+	+			[9]
Mathematics & Natural Sciences	+	+	+[4]	+	[5]	+	+	+	
Engineering & Technology		+	+			+			[10]
Agriculture	+	[2]							
Medicine	+	+	+			+			
Dentistry	+		+						
Para-medical Professions	+		+						

1 Art studies are held in the Faculty of Humanities.
2 The Faculty of Agricultural Engineering is included among the engineering faculties.
3 Separate faculties for social sciences and management.
4 Separate faculties for exact sciences and life sciences.
5. Studies of mathematics are within the framework of the Faculty of Social Sciences and Mathematics.
6 Humanities, social sciences and social work are taught at Ben-Gurion University in the framework of a single faculty — the Faculty of Humanities and Social Sciences.
7 Ruppin Institute of Agriculture (economics and administration in the cooperative kibbutz economy).
8 Bezalel — Academy of Art and Design, Jerusalem; Rubin Academy of Music and Dance, Jerusalem.
9 David Yellin Teachers College; Jerusalem College for Women; Beit Berl Teachers Training College; Levinsky Teachers College; Zinman College of Physical Education at the Wingate Institute.
10 Jerusalem College of Technology; Shenkar College of Textile Technology and Fashion.

the degree of bachelor, some 21% for the degree of master and diploma courses, some 6% for doctorates.

Table No.2 shows the number of students at the seven universities in 1982 with the fields of study broadly divided into:

1. Humanities
2. Social Sciences and Law
3. Natural Sciences, Medicine and Agriculture
4. Engineering

Table No.3 shows the number of students at the seven universities in 1982, by degree level.

The figures brought in the tables refer to the number of students, irrespective of the scope of their studies. For planning and budgeting great importance lies in estimating the number of "full-time equivalent" students (F.T.E.). Considerable differences might have been expected in this context among the different institutions and fields of study. This is in fact true for a specific field at a given institution, and differences are great. However when comparing the various universities and averaging all the fields of study it appears that the study load factor in all of them is similar.

In polls taken by the Central Bureau of Statstics in 1978 and 1979, students were asked to estimate the study load factor for their academic study program, and from this it appears that the average was 0.84, with no significant differences between the institutions.

Institutions of higher education other than the seven universities concentrate on studies for the degree of bachelor only. At Everyman's (Open) University there were in 1982 13,600 students in the academic courses in two semesters of study, this number being equivalent to some 3,400 studying in a full-time study program at a regular university. At the eleven non-university institutions of higher education there were some 3,500 students.

Rate of Study

It is difficult to compare the number of students in Israel with numbers in western world countries. There are differences arising out of variations in the division between university and post-secondary education existing in different countries. The principal age-group represented in Israel at universities differs from distribution in other countries due to army service here. It may, however, be said that in Israel the ratio of students to the population of the relevant age groups is close to that accepted in

Table 2: Students at Universities, by Faculty and Institution (1983)

Field of Study	Total	Hebrew University	Technion	Tel-Aviv University	Bar-Ilan University	Haifa University	Ben-Gurion University	Weizmann Institute
				Absolute Numbers				
Humanities	17,791	4,201	159	4,987	3,[illegible]4	3,564	1,117	9
Social Sciences & Law	17,849	4,036	193	6,662	4,101	2,130	727	-
Natural Sciences, Medicine & Agriculture	13,401	5,763	1,726	3,191	875	361	1,034	451
Engineering	8,124	-	5,572	930	-	-	1,622	-
Total	**57,165**	**14,000**	**7,650**	**15,770**	**8,730**	**6,055**	**4,500**	**460**
Special Study Programs	3,520	1,300	400	1,000	700	50	70	-
Total incl. Special Students	**60,685**	**15,300**	**8,050**	**16,770**	**9,430**	**6,105**	**4,570**	**460**
				Percentage Distribution/				
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Humanities	31.1	30.0	2.1	31.6	43.0	58.8	24.8	2.0
Social Sciences & Law	31.2	28.8	2.5	42.3	47.0	35.2	16.2	-
Natural Sciences, Medicine & Agriculture	23.5	41.2	22.6	20.2	10.0	6.0	23.0	98.0
Engineering	14.2	-	72.8	5.9	-	-	36.0	
Total	**100.0**	**24.5**	**13.4**	**27.6**	**15.2**	**10.6**	**7.9**	**0.8**
Humanities	100.0	23.6	0.9	28.0	21.1	20.0	6.3	0.1
Social Sciences & Law	100.0	22.6	1.1	37.3	23.0	11.9	4.1	-
Natural Sciences, Medicine & Agriculture	100.0	43.0	12.9	23.8	6.5	2.7	7.7	3.4
Engineering	100.0	-	68.6	11.4	-	-	20.0	-

1 Does not include students in special study programs.

Source: Central Bureau of Statistics.

Table 3: Students at Universities by Degree Level and Institutions (1982)

Institutions	Total	Bachelors'		Masters'	Doctorate	Diplomas	Special Study Programs
		Total	Of which: 1st Year				
				Numbers			
Total	**48,685**	**41,960**	**14,279**	**10,568**	**3,919**	**1,179**	**3,029**
Hebrew University	15,380	9,200	3,680	3,150	1,350	300	1,380
Technion	8,050	5,500	1,500	1,650	340	80	480
Tel-Aviv University	16,770	11,000	4,200	3,800	670	360	1,940
Bar-Ilan University	9,430	7,150	2,000	1,200	250	150	700
Haifa University	6,305	5,300	1,700	540	15	200	90
Ben-Gurion University	4,570	3,730	1,270	460	150	160	70
Weizmann Institute	480	-	-	160	300	-	-
				Percentages			
Total	**100.0**	**68.1**	**23.5**	**18.2**	**8.1**	**1.9**	**5.8**
Hebrew University	100.0	60.1	23.5	20.6	8.8	2.0	8.5
Technion	100.0	68.3	18.6	20.5	4.2	1.0	5.0
Tel-Aviv University	100.0	65.6	25.0	22.6	4.0	1.8	8.0
Bar-Ilan University	100.0	75.8	21.2	12.7	2.7	1.4	7.4
Haifa University	100.0	84.0	27.8	8.8	0.3	3.3	0.8
Ben-Gurion University	100.0	81.6	27.9	10.1	3.3	3.5	1.5
Weizmann Institute	100.0	-	-	34.8	65.2	-	-
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Hebrew University	25.2	21.9	25.2	28.7	43.9	25.6	36.9
Technion	13.3	13.3	10.5	15.1	11.1	6.9	11.6
Tel-Aviv University	27.6	26.2	29.5	34.7	21.8	25.6	28.4
Bar-Ilan University	15.5	17.1	14.0	10.9	8.1	11.1	19.9
Haifa University	10.1	12.6	11.9	4.9	0.5	17.1	1.4
Ben-Gurion University	7.5	8.9	8.9	4.2	4.9	13.7	2.0
Weizmann Institute	0.8	-	-	1.5	9.7	-	-

Source: Central Bureau of Statistics.

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France, Italy and Holland, far below the number in the United States and a little less than in Japan.

Graduates

The numbers graduating at universities in each one of recent years was around 10,000, some 70% of whom received the degree of bachelor, some 26% the degree of master and diplomas and some 4% doctorates. There has been an increase over the last decade of some 10% in the annual number of graduates and an increase of some 30% in the number of recipients of higher degrees (post-graduate diplomas, degrees of master and doctor).

Research

The principal activities at universities are teaching and research. The two functions cannot be separated, since university teaching unaccompanied by research cannot in the long run ensure adequate academic standards. Members of the academic staff engage both in teaching and in research, with the technical and administrative services assisting in both tasks. It is customary to assume that about half the overall monetary expenditure is devoted to teaching functions and the other half to research.

The universities carry out some 30% of all research and development and some 45% of all civilian research and development in Israel in the fields of science, medicine, agriculture and engineering. In the humanities and social sciences they conduct the bulk of research. Almost all basic research in the country is conducted at universities.

Budgets

Until 1974 the universities went through a process of rapid growth in students, staff and budgets. From 1974 on a period of budget restrictions began and continues to this day (see table no.4).

Most of the expenditure of the universities under ordinary budgets is earmarked for salaries of academic, administrative and technical staff. The non-salary part of the budgets includes, inter alia, allocations for scientific equipment including computers, for books and scientific periodicals, for maintenance of buildings, materials and other current expenses.

Staff at Universities

Academic staff at the seven universities numbered some 6,400 posts in 1973 (not including clinical appointments, outside lecturers and research fellows). Over the last decade there has been a decline of some 3% in their numbers. Technical and administrative staff numbered some 8,100 in 1973. Over the last decade these have declined some 11%. In addition the universties employ some 1,600 teaching and research assistants.

Table 4: Data Typifying Development of Universities over Period 1974-1982

	1974	1975	1976	1977	1978	1979	1980	1981	1982
1. Teaching									
Total No. of Students	48,140	52,088	52,510	52,980	54,060	55,790	57,500	58,970	60,685
Of whom - studying for higher degrees	10,300	12,586	11,620	11,680	11,610	12,360	12,980	13,670	14,035
Total Graduating	8,675	8,799	9,665	10,144	9,797	9,556	9,371	9,596	-
Of whom - receiving higher degrees	1,591	1,506	1,900	2,278	2,072	2,168	2,030	1,996	-
2. Staff Employed[1]									
Total	15,750	15,352	14,817	14,060	13,982	14,344	14,293	14,109	14,200
Academic Staff	6,630	6,799	6,524	6,363	6,370	6,613	6,365	6,330	6,363
Administrative and Technical Staff	9,120	8,553	8,293	7,697	7,612	7,731	7,928	7,779	7,837
3. Building Floor-space (thousand square meters)									
Total	854	926	1,051	1,063	1,083	1,142	1,156	1,214	1,286
Teaching & Research	684	740	791	802	822	865	876	934	989
Service Areas (including student hostels)	170	186	260	261	261	277	280	280	297
4. Ordinary Budget (in millions of shekels) — 1982 prices[2]	5,201	4,992	4,684	5,474	5,229	6,170	5,638	6,135	6,150[3]
Uses									
Salaries	3,525	3,442	3,152	4,042	3,870	4,783	4,489	4,867	4,860
Other Expenditure	1,676	1,550	1,532	1,432	1,359	1,387	1,149	1,268	1,290
Sources									
PGC[4]	4,313	3,851	3,583	3,847	3,593	4,328	4,099	4,567	4,352
Donations from Abroad	132	311	243	493	568	580	544	493	530
Income from Tuition Fees	354	427	529	617	486	412	292	258	250
Other Income	402	403	329	517	582	850	703	817	1,018
5. Development Budget (in millions of shekels) (in 1982 prices)[2]									
Total Investment	1,703	1,502	1,088	939	969	843	830	834	730
PGC Participation[5]	847	676	334	383	325	188	222	179	181

1 Staff positions in ordinary budget. From 1980 — new series.
2 Based on Consumer Price Index. In 1982, estimate of implementation.
3 Not included are contributions for designated objectives. Retroactive salary increments are listed in the years in which they were paid, and were not assigned to year for which they apply.
4 Based on Building Price Index.
5 PGC participation listed in the year paid and not assigned to the years to which they refer.

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Expenditure on Salaries

Overall expenditure on salaries at the universities has since 1974 risen by some 40% relative to the Consumer Price Index. According to the Central Bureau of Statistics, the average worker's income in the economy in those years rose some 35%; however the employer's expenditure on salaries for that same worker rose in that period by more than 50%, due to the imposition of new taxes on the employers and a change in the rate of National Insurance payments. These figures thus indicate that the expenditure on salaries at the universities has not kept pace with what was customary in the economy, and certainly has not exceeded it. The share of salaries in the total expenditure of the universities rose from 67% to 81%.

Non-Salary Expenditure

The most severe problem is reflected in the expenditure of universities on matters which are not salaries: scientific equipment, libraries, maintenance and current expenditure. Expenditure for these items in real terms fell by some 26% in the past decade. Over that period there was a significant increase, in real terms, in the cost of scientific equipment, books, materials, and the consumption of energy on the campuses. This fact indicates a severe crises in relation to the infrastructure needed for the maintenance of teaching and research on a satisfactory level.

Buildings

Over the past ten years there has been a growth of some 46% in the building floor-space devoted to teaching and research at universities. Floor-space of student hostels and services grew by some 76%. Today there is a total of some 1.3 million square meters of buildings available to the universities. Of these, some 77% are devoted to teaching and research and some 23% to hostels and student services. Investment in building at universities has declined considerably in recent years. Investments this year are some 65% below those of 1974.

Sources of Income

The principal sources of income for the higher education system are:

1. Allocations from the government determined and paid by the PGC;
2. Income from current donations;
3. Revenue from endowment funds;
4. Tuition fees;
5. Research contracts and research grants from government and private sources, at home and abroad;
6. Sale of services (including teaching services).

Government Allocations

Government participation in the ordinary budget of higher education remained unchanged in real terms over the past decade

in relation to the Consumer Price Index, and did not compensate the universites for the increase by some 30% in student numbers and the significant increase in real terms of workers' income in the economy. About ten years ago the government covered over 80% of the higher education ordinary budget. Direct participation by the government declined in recent years to about 65% of the ordinary budget. In addition to direct participation, the PGC allocates to the universities special grants for a variety of purposes.

The share of the higher education system in the state budget declined steeply over the last decade. Table No. 5 shows the share of the government allocation to higher education in the State budget total, less defense costs and interest on outstanding debts.

Table No.5: Ordinary Budget for Higher Education as a Fraction of the Government's Ordinary Budget, 1973-1983 (1)

Budget Year	Share of Allocation for Higher Education in State Budget (as percentage)
1973	7.9
1974	7.0
1975	5.3
1976	4.6
1977	5.6
1978	4.8
1979	5.9
1980	5.5
1981	4.4
1982	4.9
1983	4.4

(1) Not including defense expenditure and interest payments on debts.

The figures given here, together with the rise of 30% in the number of students over the past decade and the reduction in the number of employees in the universities, indicate significant financial distress created in recent years. If the higher education system is still functioning satisfactorily, it is thanks to successful fund-raising from outside sources, including donations, research grants and the sale of services and greater efforts for economy and efficiency.

Table 6: Trends in University System, over Period 1974-1983

	1974	1983	Percentage Change
No. of Students	48,140	62,500	+30%
Academic Staff (positions)	6,630	6,451	-3%
Administrative and Technical Staff (positions)	9,120	8,094	-11%
Non-salary Expenditure	3,754	2,791	-26%
Share of Higher Education in State Ordinary Budget, excluding expenditure on defense or interest on debts (percentage)	7.9	4.4	-44%
Total Floor-space of Existing Buildings (in thousand sq. mts.)	854	1,300	+52%
Total Development Budget[1]	3,815	1,350	-65%
PGC Participation in Development Budget[1]	1,897	370	-81%

1 Interim estimate for 1983 in millions of shekels (1983 prices). Assumed that prices will rise 124% from 1982 to 1983

Government participation in development budgets declined to a fifth of its value in real terms ten years ago. In 1974 the government financed some 50% of the building budget. In 1983 government participation declined to about 25% of building budgets.

Donations and Endowment Funds

Income from donations (mainly from abroad) rose in recent years. The donations are directed at three objectives: current donations to the ordinary budget; donations intended for buildings; donations to endowment funds whose revenues are used in the ordinary budget. The moneys of endowment funds are invested and universities are not allowed to use the capital itself.

University endowment funds grew in recent years, among other reasons as a result of the steep decline in the amount of building, which allowed the diversion of donations from buildings to endowment funds. PGC policy is aimed at encouraging the accumulation of endowment funds by granting incentive payments dependent on the amounts of existing funds. The accumulated value of university endowment funds in 1983 approached some 10 billion Israel shekels (April 1983 prices), and their revenues of some 600 million shekels a year are directed to current activities in the system. All moneys in the endowment funds come from donations.

Tuition Fees

Income from tuition fees forms only a small part of university income. Tuition fees are fixed by the government. The share of income from tuition fees in the ordinary budget gradually declined from about 10% in the mid-seventies to 4% in 1982. With the implementation of the "Katsav Committee's" recommendation on increasing these fees, their share rose once more to about 9% in 1983.

Research Contracts and Research Grants

The scope of research contracts and grants at universities rose in recent years. An approximate estimate of the total amount of all research allocations funded by sources outside the universities indicate a total of some 2 billion shekels a year (in 1983 prices), of which two thirds are from Israeli and one third from foreign sources. Research projects operated by these allocations are to a large extent aimed at objectives dictated by the financing bodies. Most of these demand applied research. The extent of grants in the field of basic research is relatively limited. Table 4 above summarizes detailed data concerning development of the universities in the past decade. Table 6 summarizes the changes in various factors which took place in that decade. Appendix A gives additional budgetary data on the higher education system.

2. Physical Infrastructure (Buildings and Equipment)

Building Floor-space

A description of existing conditions regarding floor-space at universities refers to the area of buildings existing today, with the addition of buildings due to be completed in the near future. We possess reliable and up-to-date figures concerning buildings, their areas and principal assignment. We do not have full and accurate details of the proportions of floor-space for different uses.

Areas were classified under two principal headings: a. teaching and research; b. student hostels and social amenities. Also included under teaching and research are administrative services, libraries, halls, classrooms etc. For our analyses we distinguished between areas allocated to the fields of humanities and social sciences (including law, education, management, arts, etc.) and those intended for the natural sciences and engineering (including medicine and agriculture). Table 7 shows the figures for floor-space under the different headings and spheres at the universities.

Areas for Teaching and Research

In order to investigate the position regarding areas allocated to teaching and to research within the two principal fields of study we had to apportion the shared areas (administration, services areas, theaters etc.) to one or the other of them. We calculated this according to the ratio of students in the various fields in the particular institution. If at a given university 70% of the students are studying in the faculties of humanities and social sciences, we apportioned 70% of the areas for administration, services and theaters to these fields. Corrected appproximate estimates were obtained in this manner of the area for teaching and for research according to the principal fields of study.

The figures at our disposal were analyzed with reference to the number of students in the different fields of study and the various degree levels. Research activities were only indirectly taken into account by additional weighting of students working for higher degrees in the fields of the natural sciences and engineering, fields where research requires laboratories and extensive space.

There is considerable difference between the areas required for humanities and social sciences on the one hand, and the natural sciences and engineering on the other.

"Required Floor-space per Student"

In order to determine the **relative** position of the different universities, we took into account the building floor-space and the

Table 7: Building Floor-space at Universities,[1] by Usage (thousand m²)

Institution	Total	Floor-space for Study & Research			Floor-space for Social Amenities and Hostels	
		Humanities & Social Sciences	Natural Sciences & Engineering	Shared Space (Administration, Service Areas, Lecture Rooms etc.)	Social Amenities	Student Hostels
Total	**1310**	**260**	**580**	**165**	**60**	**245**
Hebrew University	455	100	150[2]	50	40	115
Technion	285	-	195	35	10	45
Tel-Aviv University	220	65	105	25	5	20
Bar-Ilan University	85	20	25	15	5	20
Haifa University	70	60	-	..[3]	..[3]	10
Ben-Gurion University	105	15	35	25	..[3]	30
Weizmann Institute	90	-	70	15	..[3]	5

1 Including buildings nearing completion.
2 Estimate of space to be available to Faculty of Science at the Hebrew University after moving to Givat Ram. Not including areas to be vacated and sold or transferred to outside bodies.
3 Included in areas of other buildings.
Source: Information provided to PGC by the universities.

number of students in each of the two principal fields, and within each one — we referred to the number of students for each degree level. The number of students in each institution was weighted by calculation of the "required floor-space per student", the calculation differing from field to field and for the various levels of degrees. If the area required for undergraduates in humanities and social sciences is defined as one unit, then the "area required per student" for higher degrees and in the fields of science and engineering varies from 1.5 to 4.0 units. The weighting is determined by reference to the planning standards accepted in foreign countries, mainly in Britain and Canada. These countries are halfway between countries where there is comparatively great prosperity (U S) and countries where universities are extremely overcrowded (France and Italy). In order to allow for the needs of research in science and engineering we increased the weighting of the "area required per student" for those studying for the degree of master by 35% and for doctoral students by 100%.

Comparison Between the Various Universities

The figures obtained from various analyses and from different weightings permit a comparison between universities in the two principal fields. This comparison serves as a base for decision making concerning the directions of physical development in coming years. Table 8 shows the **relative** situation at the different institutions, based on a comparative index. The country-wide average in each field is defined as 100. We bring here the principal conclusions of an estimate of the physical capacity and needs for building at the various universities derived from the comparative analyses.

We must first state that in our estimation, after comparison of the two principal fields — humanities and social sciences on the one hand, natural sciences and engineering on the other — the situation for the latter is better from the aspect of floor-space and that in general it is possible to admit additional students with the present floor-space. There are of course specific needs in certain fields and certain institutions. Regarding humanities and social sciences where the floor-space situation is worse, the shortage is in fact concentrated in two universities, Tel-Aviv and Bar-Ilan, as detailed later.

Floor-space Situation for Study and Research in each of the Universities

Analyses and conclusions concerning the floor-space position for study and research at the seven universities are as follows:

The Hebrew University: After completion of the Mount Scopus campus and the placement of the whole Givat Ram campus at the disposal of the Faculty of Science, the Hebrew University is in a

Table 8: Building Floor-space Devoted to Teaching and Research, in Relation to the Number of Students [1] (Comparative Indices)

Institution	Total Study & Research	Humanities & Social Sciences	Natural Sciences & Engineering
National Average[2]	100	100	100
Hebrew University	115	150	100
Technion	120	-	110
Tel-Aviv University	85	75	95
Bar-Ilan University	60	50	115
Haifa University	100	120	-
Ben-Gurion University	95	175	75

1 Number of students weighted according to "floor-space required per student" in the various fields and for different degree levels.
Indices above 100 show space available better than national average.

2 Not including Weizmann Institute.

Source: Evaluated by PGC team based on data with regard to space available (see Table 7) and assumptions of "floor-space required per student".

position where, in our opinion, it is possible to admit 2,000-3,000 additional students in the humanities and social sciences in the existing buildings, as well as another few hundred in the natural sciences. Hence from the aspect of teaching and research needs the Hebrew University does not require additonal floor-space, except perhaps on a modest scale for isolated projects and for scientific purposes.

The Technion: At the Technion, too, an extensive building program is drawing to completion, including projects in the faculties of engineering, medicine and the natural sciences. Hence we are sure that there is generally a reserve for the absorption of 1,000-1,500 additional students in the institution as a whole. There are specific needs such as, for example, the development of the field of nuclear engineering, which will require additional space. The Technion has a program for completing the transfer of the Faculty of Architecture from its present location on Hadar Hacarmel to the campus in Neve Shaanan.

Tel-Aviv University: In general, the situation in the field of experimental sciences is relatively good, and in our estimation it should even be possible to admit a few hundred additional students. There are specific needs in fields which should be developed (electronics, computers, dentistry), which will require special buildings.

In the humanities and social sciences the university is in an inferior position, and in our opinion most of the efforts during the coming five years should be devoted to buildings required for classrooms libraries and workspace for the academic staff in the humanities and social sciences (including education, social work, management and the like). We refer to building to an extent of 20-25,000 square meters, that is an increase of 25 — 30% over the existing areas.

Bar-Ilan University: In the Faculty of Science, which from the aspect of student numbers represents a comparatively small part of the activities of the university (10%), there exists in our estimation a reserve for the absorption of several hundred additional students, especially since according to plan, space which today is occupied by other faculties will become available for this faculty.

Humanities and social sciences are in a difficult situation justifying the addition of space for classrooms, libraries, offices for members of the staff etc. In order to bring this university to a position comparable with the national average, areas available to these faculties should be doubled, which means an addition of some 25,000 m^2.

The University of Haifa: Building of the campus in past years placed the institution in a position of balance. Concerning the functions of classrooms, rooms for the academic staff, offices etc. there is in our estimation even a reserve for the admission of several hundred additional students in the humanities and social sciences, in which fields the university is chiefly engaged. There is a specific need for the completion of the central library.

Ben-Gurion University: In the humanities and social sciences we believe there is a reserve for the admission of hundreds of additional students from the aspect of space available. There may possibly be a need to solve specific problems such as a certain shortage of offices for the academic staff and of classrooms, but to no great extent.

In the field of experimental sciences additional space is required mainly in the Faculty of Engineering (partly to permit a change of

location) and for the School of Medicine to an extent of some 30%, i.e. some 15,000 square meters.

Weizmann Institute: As indicated above, the needs of the institute cannot be analyzed by the same criteria as used for the other universities. For specific needs an additional 10% of floor-space over the present area of buildings for research is required.

Student Hostels

As far as the availability of student hostels is concerned there are differences between institutions of a more national nature, whose student population comes partly from distant regions, and those with a more local population.

In Table 9 we bring data on the number of places in student hostels at different universities. The number also includes what today is under construction.

These data were compared with the number of students coming from outside the region, estimated by us on the basis of previous surveys. See Appendix B for a discussion of geographic aspects of student distribution.

It must be kept in mind that investment in accommodating one student in a hostel is more or less identical with the investment necessary to produce a place of study for an average student, including classroom space, libraries and the space required for research by the academic staff. Floor-space per head in hostels is 20 square meters gross. Space needed per student in the humanities and social sciences is some 10 square meters and for a student in experimental sciences about 30 square meters.

The PGC has already decided that the cost of maintenance of student hostels (including indirect but not capital cost) must be covered in full by the rent paid by the student. This means a gradual reduction in the rate of subsidies prevailing today (and at rates differing from one institution to the next) and hence also a lower pressure of demand.

Social Amenities

Social amenities at the universities serve both students and staff. They include restaurants, health services, sports, culture and other facilities. However, there are considerable differences between the institutions. If we relate the space to the number of students (even though, as was said, it also serves the staff) we find the situation as shown in Table 10.

Table 9: Number of Students from Outside University Neighborhood in Relation to Number of Places in Student Hostels

Institution	Number of Places in Hostels[1]	Number of Students from outside the Neighborhood[2,3]	Ratio of No. of Places to No. of Students from outside Neighborhood
Total	13,430	21,700[1]	0.62
Hebrew University	6,980	8,400	0.83
Technion	2,060	4,100	0.50
Tel-Aviv University	1,090	2,700	0.40
Bar-Ilan University	1,050	2,100	0.50
Haifa University	530	1,900	0.28
Ben-Gurion University	1,550	2,500	0.62
Weizmann Institute	170	-	-

1 Information given to PGC by the universities.
2 Estimate by PGC based on data from Central Bureau of Statistics.
3 Includes students from abroad and in pre-academic preparatory courses.

Table 10: Social Amenities at Universities

Institution	Floor-space (Average per student) for Social Amenities (m^2)
Total[1]	*1.2*
Hebrew University	2.7
Technion	1.5
Tel-Aviv University	0.5
Bar-Ilan University	0.7
Haifa University	0.7
Ben-Gurion University	0.3

1 Not including Weizmann Institute.
Source: Information given to PGC by the universities.

It must be kept in mind that there are differences in the demand for services of this sort, between "regional" institutions whose population comes largely from the immediate neighbourhood, and the others.

Institutions other than the Seven Universities

In institutions other than the seven principal universities there is a shortage of buildings in a number of fields. The rapid expansion of **Everyman's University** requires further construction in addition to the total space of 5,000 m^2 available to the institution today. Space available to the **"Bezalel Academy"** is some 9,000m^2. This area does not fill the needs. The buildings are old and scattered all over Jerusalem. The Academy needs additional space, and it is essential to consolidate its premises in one single location. **The Jerusalem Academy of Music** is also in a state of congestion. The total floor-space available to it is some 2,400 m^2. This does not meet the needs. **Jerusalem College of Technology** is located on a new campus with buildings totaling 5,000 m^2. This space meets present teaching needs. The College has plans for future additional building.

Equipment, Computers, Libraries

The physical infrastructure of the universities includes not only the buildings but also the equipment intended for teaching and research including computers, scientific instruments, books and periodicals etc.

The conduct of teaching and scientific research at an advanced and up-to-date level is conditional on well-developed arrays of scientific instruments and libraries. Funds allocated for these purposes in the higher education system in the past decade were the victim of repeated budget cuts. As previously mentioned, the expenditure in real terms on non-salary items declined at universities by some 26% over the past decade.

Undoubtedly a further reduction of the means allocated for scientific equipment and libraries will create an intolerable situation. Obsolete equipment is liable to lead to latent unemployment for scientists not equipped with the necessary instrumentation and to non-competitive scientific research. Inadequate libraries adversely affect both the standard of research and the level of teaching.

Scientific Equipment

There is evidence of real harm to the standards of equipment needed for research in the natural sciences, engineering, medicine and agriculture. The monetary value of scientific equipment purchases in the system as a whole has in recent years fallen to 3%

of the ordinary budget. The PGC has for the last five years made special allocations for the purchase of costly research equipment at universities. PGC allocations for this item have gradually grown and reached about 100 million shekels a year in 1983, but they cannot provide for all the needs. Most of the equipment purchased by the universities has been financed by donations and research grants from foreign sources.

Computers

Conditions of computer centers at most universities are satisfactory and most of them are ready for the purchase in 1983-1984 of new-generation central computers. The PGC decided in 1983 to allocate some 40 million shekels (in 1983 prices) per year for five years, as a special contribution to the purchase of new computers. It was also decided to set up an inter-university computer center which would be operated in the framework of one of the computer centers already existing at the universities. The center will, among other things, deal with the establishment of a communications network between the university computers, and the exploitation of surplus computing capacity available in one place, by another institution.

University computers serve first and foremost the needs of scientific research. With that, the use of computers for teaching purposes has spread considerably in recent years. Within a number of years we shall have to reach a situation where nearly every student in all fields of study will take at least one course in this subject.

Libraries

University libraries have gone through a process of belt-tightening, which to begin with perhaps led to more efficiency and saving, but as it persisted, began to endanger the proper functioning of the system. By counterpart allocations the PGC is encouraging universities to allocate additional funds for their libraries but the present situation is far from satisfactory. The PGC sub-committee for libraries is endeavoring to attain computerization and close cooperation between all university libraries.

3. Academic, Technical and Administrative Staff

University Staff

The most accurate figures available on staff employed at universities are for the 1979 academic year. These data are based on the detailed manpower census conducted in 1980-2 by Eliahu Israeli on behalf of the PGC. It must be emphasized that at universities dependent on ordinary budget allocations there are significant differences between manpower standards and the numbers actually employed, some being financed by research grants and special income from the sale of services. Such additional employees usually work on a temporary basis. According to the 1979 census, the universities had some 17,800 full-time positions for employees receiving a monthly salary. Of these posts some 4,100 were senior staff members, 1,900 junior staff, 1,600 teaching and research assistants, 3,200 technical and 6,600 administrative staff. Between 1979 and 1983 there were, it seems, no significant changes in the numbers employed.

Table 11 shows the distribution of these posts among the seven universities.

Numerical Teacher -to-Student Ratio

Absorptive capacity of universities and their effectiveness in maintaining a teaching framework is inter alia measured by the numerical ratio of teachers to students. The number of teaching posts within the ordinary budget at the universities (apart from the Weizmann Institute) is around 5,000. Nearly half these teachers are in the humanities and social sciences (compared with 62% of the students) and just over half in science and engineering (as against 38% of students).

In 1983 the numerical ratio of students to teachers was about 15:1 in the humanities and social sciences and about 8:1 in the natural sciences, medicine, agriculture and engineering. Overall the ratio is about 11.5:1. The figure accepted in England as desirable is 10:1. A much higher ratio is generally agreed to have an adverse effect on the quality of teaching and research.

Student-to-teacher ratio averages must be used with caution in view of the differences between the various institutions, the faculties and fields of study. The degree level too must affect the number of teachers. Studies for higher degrees necessitate a much lower ratio of students to teachers.

For the purpose of testing comparable situations among the various universities we referred to two principal fields:

Table 11: Personnel[1] at Universities in 1979 by Grading Types (full-time posts)

Grading	All Institutions	Hebrew University	Technion	Tel-Aviv Univ.	Bar-Ilan Univ.	Haifa Univ.	Ben-Gurion University	Weizmann Institute
Grand Total	17,813	5,482	2,913	3,885	1,389	870	1,593	1,681
Academic Staff - Total	**7,984**	**2,368**	**1,136**	**2,162**	**729**	**460**	**764**	**365**
Senior Academic Staff[2]	4,109	1,197	609	938	365	264	409	327
Junior Academic Staff[2]	1,921	589	232	489	262	95	254	
Teaching and Research Assistants[4]	1,575	545	286	507	102	60	75	
Other Teaching & Research Staff[5]	378	37	9	228	-	41	26	38
Technical Staff-Total	**3,227**	**795**	**899**	**408**	**102**	**26**	**280**	**717**
Administrative Staff-Total	**6,602**	**2,319**	**878**	**1,315**	**558**	**384**	**549**	**599**

1 Active employees, i.e. persons employed on monthly salary paid out of the ordinary budget, research budgets, self-supporting budget items and those with outside financing; figures do not include staff abroad on sabbaticals, pensioners, persons paid on an hourly basis and piecework contractors.

2 Grade of "lecturer" and up.

3 Not including master and doctor scholarship students at Weizmann Institute: 400 in number.

4 Not including master students with "assistant" grade at the Technion.

5 Includes instructor in "(medical) doctor" grading, in teacher's grading and those employed under special contract.

Source: "Manpower Census at Universities", conducted by E. Israeli.

a. humanities and social sciences (including law, education, management and arts).
b. natural sciences and engineering (including agriculture and medicine).

Difficulties arise in more detailed analysis since in many cases teachers in one faculty teach students from some other faculties, and the ratios of students to teachers for a given faculty lose their significance. In view of this we decided on two classification groups, the broadest possible, defined as above.

For comparison we used a different weighting of students studying for the degrees of bachelor, master and the Ph. D. The weighting factors used were different for humanities and social sciences on the one hand and for natural sciences and engineering on the other.

The weighting we selected varied from 1.0 to 3.0, 1.0 being for undergraduates in the humanities and social sciences and 3.0 for doctoral students in the natural sciences and engineering.

Table 12 shows comparable figures for the different universities in each of the two principal groups.

Table 12: Numerical Ratio of Students to Instructor[1]
(Comparative Indices)

Institution	Humanities and Social Sciences	Natural Sciences and Engineering
National Average	100	100
Hebrew University	90	90
Technion	-	125
Tel-Aviv University	100	95
Bar-Ilan University	105	80
Haifa University	115	-
Ben-Gurion University	70	75

1 Number of students weighted according to different degree levels. Indices over 100 indicate a greater number of students and/or a smaller number of instructors compared with national average.

It must of course be borne in mind that the national average is an arithmetical result and does not represent a desirable norm. As stated above, the desired proportion of students to teachers is lower than that existing in the system at present. The figures presented here do not refer to the volume of research conducted at each institution and do not allow for complementary or extra-mural studies. Hence these figures do not exactly reflect the relative efficiency of the institutions.

Comparison between Universities

In every case, and no matter what weighting was used or basis chosen for the data, we arrived at the following conclusions: in the fields of humanities and social sciences the Hebrew and Ben-Gurion Universities are below the national average. Both universities are able to admit additional students in these fields without having to increase significantly academic staff numbers.

Tel-Aviv and Bar-Ilan Universities are close to the national average, with Bar Ilan in a slightly more difficult position. Haifa University lies above the national average, even when we allow for the comparatively small number of higher degree candidates. Haifa University will therefore need additional staff if additional students are to be admitted.

In the fields of natural sciences and engineering the highest ratio of students to teachers is at the Technion. That arises mainly out of the situation in the popular and preferred faculties (electronics and computers) where there is a shortage of academic staff. The shortage is not due to a lack of positions, but to the difficulty of recruiting suitable staff under existing conditions on the employment market. At each of the universities there are considerable differences between the various departments. In the field of natural sciences (except for computers) there is room for additional students, mainly at Ben-Gurion University, Bar-Ilan University and the Hebrew University, and to some extent also at Tel-Aviv University.

Administrative and Technical Staff

An examination of the numbers of administrative and technical staff reveals considerable differences between the universities. The relative weight of technical staff is especially high at the two scientific-technological institutions: the Technion and the Weizmann Institute. The number of technical staff at all the institutions faithfully reflects the extent of activity in the fields of natural sciences, agriculture, medicine and engineering, and the extent of contracted research at these institutions. As for

administrative staff their number is largest in the Hebrew University.

There can be no doubt that the higher education system has greatly increased in efficiency over the last decade, with the ratio of administrative and technical staff to students changed from about 1:5 in 1974 to almost 1:8 in 1983.

Chapter 3: Forecasts

1. Student Forecasts

In 1983 some 62,500 students were studying at the seven principal universites. In recent years the increase in student numbers has been about 2-3% annually. Forecasts indicate growth continuing at a similar rate in the next few years, rising to about 3-4% at the end of the eighties and early nineties.

In this document we are dealing with two target years, 1988 and 1995. The main and more detailed discussion deals with 1988, when forecasts indicate there will be some 70,000 students. Further growth is expected to raise this total to about 85,000 by 1995.

Regularly every two to three years the PGC reviews forecasts of student numbers at universities. Student potential forecasts were last updated in 1981, by N. Baruch & Co., Consultants and Research Ltd. and published by the PGC in the brochure entitled "Forecast of New Student Potential in Institutions of Higher Education over the Period 1981-1997". In 1982 a student forecast including graduates drawn up for the PGC by M. Egosi awaits publication.

The trends reflected in the forecasts agree with the internal investigation conducted by the PGC's professional staff. We here present the principal findings of these forecasts.

Forecasts for 1988

Concerning 1988 the following assumptions were made:

a. Potential number of recipients of matriculation certificates will materialize as forecast.

b. The proportion of successful matriculants going on to higher education will remain largely unchanged.

c. The trends appearing in recent years of demand for the different fields of study will continue without significant change.

d. There will be no significant change in the proportions of those studying at the different degree levels.

Table No. 13: Forecast of Students at Universities for 1988, by Degree Levels and Fields of Study, with Forecast of Growth over 1982

Degree and Field of Study	Forecast of 1988		Position in 1982		Estimated Growth
	Absolute Numbers [1]	Percent [2]	Absolute Numbers [1]	Percent [2]	Absolute numbers [1]
All degrees — total	**66,500**	**100.0**	**57,165**	**100.0**	**9,335**
Humanities	20,250	30.5	17,790	31.1	2,460
Social Sciences & Law	21,550	32.4	17,845	31.2	3,705
Natural Sciences, Medicine, Agriculture	14,400	21.7	13,410	23.5	990
Engineering	10,300	15.4	8,120	14.2	2,180
Bachelors — total	**49,000**	**73.7**	**41,960**	**73.4**	**7,040**
Humanities	14,950	22.5	13,290	23.3	1,660
Social Sciences & Law	16,600	25.0	13,460	23.5	3,140
Natural Sciences, Medicine, Agriculture	9,450	14.2	8,960	15.7	490
Engineering	8,000	12.0	6,250	10.9	1,750
Masters & Diploma Studies — total	**13,950**	**21.0**	**12,130**	**21.2**	**1,820**
Humanities	4,300	6.5	3,700	6.5	600
Social Sciences & Law	4,500	6.8	3,970	6.9	530
Natural Sciences, Medicine, Agriculture	3,200	4.8	2,900	5.1	300
Engineering	1,950	2.9	1,560	2.7	390
Doctorates — total	**3,550**	**5.3**	**3,075**	**5.4**	**475**
Humanities	1,000	1.5	800	1.4	200
Social Sciences & Law	450	0.7	415	0.7	35
Natural Sciences, Medicine, Agriculture	1,750	2.6	1,550	2.7	200
Engineering	350	0.5	310	0.6	40
Special Study Programs	**3,500**		**3,520**		**-20**
Total, incl. Students in Special Programs	**70,000**		**60,685**		**9,315**

1 Numbers rounded off at each degree level.
2 Not including students in special study programs.

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With these assumptions it will be possible to examine broadly how the 70,000 students expected in 1988 will be distributed among the different fields of study and the degrees at the various levels. It must be remembered that this forecast cannot reflect policy changes which may yet be made, but it can serve as a basis for planning. Table 13 sums up the figures expected for 1988 and the estimated number of additional students compared with 1982.

The forecast indicates an additional 9,300 students over the number for 1982. Some 7,000 additional candidates will study for the degree of bachelor, 2,200 of them in the fields of natural science and engineering. An additional 1,800 students are expected for the degree of master and post-graduate diplomas, 700 in the natural sciences and engineering.

For doctorates an additional 500 candidates are expected. This estimate must be treated with caution in view of the length of studies and the sensitivity to trends on the labor market.

Forecast for 1995

The number of students forecast for 1995 is based on the same assumptions as those made for 1988. On these same assumptions the total number of students in 1995 is expected to be about 85,000, that is an addition of about 23,000 to those in 1983. This growth raises a number of important questions which are the subject of a separate discussion concerning the laying down of policy for the expansion of the higher education system.

2. Supply and Demand Forecasts for Academically Qualified Manpower

Preparation of supply and demand forecasts for professional manpower, particularly in professions requiring academic training, represents an important part of planning processes for the economy. The forecasts are needed to pinpoint gaps and bottlenecks which could hold up completion of plans. They permit decision-making and selection of courses of action for raising or lowering the rate of training of professionals when a shortage or surplus respectively might be developing.

Limitations of Manpower Forecasts

It may be pointed out that all manpower forecasts have a great number of limitations. The supply side is largely affected by factors such as the scale of immigration or the rate of return of Israelis from abroad. It is hard to predict the scale of immigration or the number of Israelis returning. In professions where these have pronounced effect, supply forecasts must be treated with

caution. The demand side is affected by the general state of the economy, economic growth, policy of government ministries in the social and welfare spheres etc. Uncertainty about each one of these factors is considerable. There are also the mutual influence and interdependence of supply and demand.

The minimum reaction time for the system of higher education varies from five years in the case of bachelors in the humanities, natural and social sciences, up to about fifteen years for doctorates. These long intervals make planning more difficult if attempts are made to regulate the rate of academics qualifying at universities to the needs of society and the economy.

State agencies which in recent years have been active in manpower planning are the Economic Planning Authority and the Manpower Planning Authority. During all their years of operation the forecasts prepared by these agencies have assisted the PGC which also initiated additional investigations and forecasts.

The overall forecast of supply and demand in the economy for academic workers indicates equilibrium over the next few years. This forecast does not refer to specific professions. Its main significance lies in those spheres where there is only a loose connection between the profession studied at the university and the eventual occupation of the graduate. The number of students studying today in the universities meets the country's needs. These fields include most of the social sciences and humanities, and to some extent also law and undergraduate studies in the natural sciences.

In some professions special forecasts were made. The principal findings are:

Medicine

Medicine. At the end of the seventies about a third of the doctors annually joining the health services were graduates of medical schools in Israel; one third were Israelis who had studied abroad and a third were new immigrants. The latest forecast was made in 1981 by the Economic Planning Authority. This forecast predicted a considerable surplus of doctors in 1989. The surplus expected by that forecast is some 2,000 doctors at the end of the decade (compared with a total expected demand of some 13,000 doctors at that time). Since publication of the forecast, the rate of immigration from the USSR has decreased and Israeli students are experiencing difficulty in gaining admission to universities in Italy. These facts necessitate a new forecast in the near future (see Appendix C).

Dentistry

Dentistry. In view of the growing shortage in the country, the Ministry of Health has brought up for discussion the need to train additional dentists. The Chairman of the Council for Higher Education appointed a committee which examined the situation and presented its recommendations. The committtee concluded that a shortage of dentists was expected and recommended that the number of students studying dentistry in the universities be increased.

Engineers

Engineers. The Ministry of Trade and Industry published in 1983 a forecast of supply and demand in the engineering professions. According to the forecast a shortage of some 5,000 engineers is expected in 1992 (out of a total demand of some 45,000). The main shortage will be felt in the fields of computers and electronics. The forecast predicts a rapid expansion of the "sophisticated" industries which require many engineers. An even greater shortage is expected of practical (non-academic) engineers and technicians, so the shortage of engineers cannot be solved by offering academic engineering training to these practical engineers and technicians (see Appendix D).

Social Workers

Social Workers. The Chairman of the Council for Higher Education appointed a committee to investigate the need for and the possibilities of training more social workers. The committee presented its report in April 1981. It contained two different forecasts of supply and demand for social workers. According to one forecast a surplus will develop; according to the other, there would be a slight shortage. The PGC examined the forecasts and, after extensive discussion, concluded that a balance or even a slight surplus was expected in this field in the next few years.

In additional professions such as veterinary medicine, para-medical professions and scientists engaged in research and development, various investigations have been made at the instigation of, or in coordination with, the PGC. The conclusions which may be drawn from all the forecasts and investigations will be presented in Chapter 4/sub-chapter 2.

3. Academic Staff: Forecast of Replacements and Retirement

Additional Academic Staff Required

The number of active posts for **senior** academic staff, from the grade of lecturer and above, at the universities is over 4,000. In order to maintain a more or less constant proportion of teachers to students the number of **senior** staff members has to be increased

Table 14: Age Distribution of Full-time Senior Academic Staff Positions at Universities in 1979, by Institution (percentages)

Institution	up to 55	56-60	61-65	66 and over	Total, 56 and over
Total	**84.8**	**8.4**	**4.6**	**2.2**	**15.2**
Hebrew University	84.7	8.7	5.0	1.6	15.3
Technion	81.5	9.9	4.1	4.5	18.5
Tel-Aviv University	85.6	7.8	4.6	2.0	14.4
Bar-Ilan University	78.4	9.6	7.8	4.2	21.6
Haifa University	81.5	11.1	5.0	2.4	18.5
Ben-Gurion University	92.6	3.4	3.0	1.0	7.4
Weizmann Institute	89.0	8.5	2.3	0.2	11.0

by about 100 a year. In order to improve this proportion somewhat, and mainly so as to increase the number of teachers in the fields where rapid expansion is taking place, a few dozen additional staff members should be added each year. The addition required annually is therefore between 100 and 150 senior staff. This is the "net" increase without allowing for those retiring or leaving the system for any other reason.

Rate of Retirement

Some 40% of academic staff are over 50 and will retire by the year 2000. Some 12% are over 60 and will retire before the end of the eighties. The present rate of retirement is quite slow. Some 40 to 50 senior academic staff retire each year. By the mid-eighties the retirement rate will rise to about 80 to 90 a year, and in the first half of the nineties will reach 100 a year and more. Numerically, this means that over the five years 1983-1988 there will be an average demand of some 60 new senior academic staff members to replace those retiring. In the next few years the system will therefore need some 200 new staff members a year in the grades of lecturer and above, just in order "to mark time". In the early nineties the number required annually will go up to about 250.

Situation at Different Universities

The age structure of academic staff at the different universities indicates significant differences among them. From a detailed manpower census completed in 1982, referring to 1979, some 15% of the senior staff were aged 56 and over. Table 14 shows a breakdown of ages in that year at different universities, for staff members who then were over 56 and are now 60 and over. The senior staff at Ben-Gurion University is the "youngest", followed by the Weizmann Institute. At Bar-Ilan University an extremely rapid rate of retirement and replacement can be expected in the near future.

Difficulties in Recruitment of Suitable Staff

All the quantitative analyses presented herein deal with one aspect of the problem. Another is the academic — qualitative aspect. In order to preserve academic standards and even to raise them, we need some 200 to 250 new university lecturers every year until 1995, and these must meet academic criteria of research and teaching.

Recent years have for the first time seen a flight of the young generation from university positions. This is particularly in evidence in spheres with a prosperous private market, able to offer tempting material terms, and at times even to pose intellectual challenges of the first order. In the fields of law, business management and accountancy on the one hand, and in electronics

and computers on the other, universities find it hard today to obtain suitable additional academic staff. It is no coincidence that just these fields are among those most in demand by students and the shortage of teaching staff is especially noticeable.

In the humanities and the natural sciences difficulties may arise in finding high quality academic staff. **The qualitative problem is, in our opinion, the greatest challenge facing the system today, when planning the rate of recruitment of new young lecturers over the coming decade.**

Budgetary Repercussions

The process of retirement also has important budgetary significance, but this varies from one institution to another. Where pensions are handled by outside pension funds, the retirement of staff members releases the funds necessary for engaging the new young lecturers who are to replace those retiring. These institutions will be able to make the necessary replacements with no great financial difficulties. On the other hand, in institutions having full or partial budgetary pensions, the growing rate of retirement in the later eighties will create an additional financial burden and will make appropriate replacement more difficult.

Chapter 4: Conclusions and Decisions: 1983 - 1988

1. The System of Higher Education in 1988 An Overall View

Students in 1988

Based on forecasts and national needs we expect that there will be some 70,000 students at the seven universities. To these must be added the students at Everyman's University and those in non-university institutions of higher education.

These students can be absorbed in institutions as they exist today, with the changes and additions necessary. Hence the system of higher education in 1988 will be similar to that existing today, with no revolutionary changes or additional universities.

Forecasts concerning the number of students and the needs of the economy for academically trained manpower, together with the data concerning the human and physical infrastructure of existing institutions lead to the following general conclusions:

No Need for New Universities or Faculties

a. **Israel will need no new universities before the end of the eighties. Universities existing today will, with appropriate changes and expansion, be able to meet the country's needs in all professions and in every part of the country.**

b. **In the coming five years there will be no evident need for establishing new faculties at the universities.** We will manage with the existing faculties, i.e. four medical schools, two schools of dentistry, three of engineering, one of agriculture, three law schools etc. Some of the existing faculties will have to expand and new units will have to be set up in existing faculties.

c. In the coming five years there will be no evident need for establishing new non-university institutions of higher education except for the academization of the teacher training colleges.

We expect that by 1988 about six of the teacher training colleges will become institutions of higher education awarding the degree of bachelor of education (B.Ed.).

d. The State of Israel has no interest in, nor national need for, the establishment of institutions of higher education exclusively connected with specific sectors of the population or the economy. Within the limits of the funds allocated by the State to the higher education system there is no room in the coming few years for the establishment of institutions such as a university for the Israel Defence Forces, for kibbutzim, for the Federation of Labor, for the Arab sector, or for additional religious or any other sectorial university. Geographic distribution of existing universities meets the needs of the north and south of the country. The needs of the Galilee and the Negev will in the coming five years be met by Haifa and Ben-Gurion Universities and by the regional colleges at Tel Hai, the Jordan Valley, "Ohel Sara", "Shaar ha'Negev" and Eilat. In the central region there is, of course, no shortage of institutions of higher edcucation.

e. In the next five years the academic courses in regional colleges, for which the parent universities bear the academic responsibility, have to be put on a firmer basis. The courses in Everyman's University have much to contribute to higher education. Together, the regional colleges and Everyman's University can solve higher education problems, in particular of working students who live far from the great centers of population.

f. A situation demanding more significant changes in the existing system will develop only towards the start of the nineties. We shall return to this in chapter 5, where we offer a first glance at 1995.

Absorptive Capacity

A detailed examination of absorptive capacity existing at the various universities today shows considerable differences between Tel-Aviv and Bar-Ilan Universities on the one hand and all the rest on the other.

The growth rate at Tel-Aviv and Bar-Ilan Universities has been extremely rapid in recent years. 35% of all students in Israel studied at these two universities in 1970 and some 44% in 1982. The expansion of the physical infrastructure in these universities has not kept pace with needs.

Table 15: Distribution of Student Numbers According to Universities in 1982 & 1988

Institution	No. of Students in 1982	No. of Students forecast for 1988 -Trends unchanged	Desirable Distribution of Students in1988
Total[1]	60,225	70,000	70,000
Hebrew University	15,300	17,500	18,400
Technion	8,050	9,500	10,000
Tel-Aviv University	16,770	19,500	18,400
Bar-Ilan University	9,430	11,000	10,000
Haifa University	6,105	7,200	7,200
Ben-Gurion University	4,570	5,300	6,000

1 Not including Weizmann Institute of Science.

Changes in Distribution of Students Among Universities

As against this, the share of all other universities in the student total declined, though they possess adequate infrastructure which would allow them to admit additional students.

For all these reasons we arrived at the conclusion that everything possible should be done to alter, to some degree, the distribution of students among the universities. In Table 15 we present the number of students expected at the universities (excluding the Weizmann Institute) in 1988, if present trends continue unchanged, compared with the distribution which to the PGC seems more desirable, both for fuller utilization of existing facilities and to further the national policy of population dispersal.

A discussion of geographic aspects of student distribution will be found in Appendix B.

As in most western countries, so in Israel, the PGC does not favor a policy of directing students to a particular university. We are, however, convinced that a number of steps must be taken to help us approach the desired distribution as far as possible. Among such steps we would include:

a. Slowing down the growth in the number of undergraduates in humanities and social sciences at Tel-Aviv University.

b. Slowing down the growth or even freezing the number of students in the social sciences at Bar-Ilan University.

c. Increasing the number of students admitted to the Technion, particularly in those faculties where shortages are felt on the local labor market.

d. Attempting to increase appreciably the number of students at Ben-Gurion University while creating a suitable infrastructure — mainly student hostels — to absorb them.

e. Increasing the number of students in the humanities and the natural sciences at the Hebrew University.

In discussions between the PGC and the heads of the different universities no significant differences of opinion emerged on these aims. Only in 1988 will we know if the system succeeded in this first attempt at regulating the number of students at universities.

Inter-university Cooperation.

A central aim of the PGC is the attempt to strengthen inter-university cooperation. Over the coming few years various efforts in this direction will continue. These include:

a. Computers. The PGC decided to set up an inter-university computing center (IUCC) to be established within the framework of one of the existing computer centers. The center's location is to be determined in June 1983. Its tasks will include setting up a communications network between university computers; coordination of purchases; increased sharing of the use of software in the fields of administration, teaching and university libraries; continually checking the need for acquiring a single giant computer for the whole higher education system; utilization of surplus computing capacity in one institution by the others.

b. Libraries. The PGC's libraries committee is actively promoting joint cataloguing, unified computerization and the inter-library use of materials with the purpose of effecting savings.

c. Uniform Entrance Examinations. On the initiative of the Committee of Heads of the Universities and with PGC support an inter-university center was set up for uniform psychometric tests, the first of which will be held in 1984.

d. "Perah" Tutorial Project. The national directorate of the project operating in all the universities is at the Weizmann

Institute. A public council and a public directorate decide policy and direct joint activities. The PGC finances a significant part of the "Perah" budget.

e. Pre-Academic Preparatory Courses. Direction of the pre-academic preparatory courses was entrusted in 1983 to the Association for the Advancement of Education, a Ministry of Education and Culture organization. In the near future the Minister of Education and Culture is due to appoint a public council and directorate (similar to those directing "Perah") which will include representatives of the Ministry of Education and Culture and the universities, and which will draw up a common policy for the preparatory courses.

Among other subjects which may be cited are: cooperation in oceanography; inter-university activity in the field of life sciences collections; and proposals yet to be implemented concerning joint purchases of equipment and joint student registration.

Students from Abroad

Israeli universities have naturally a special interest in welcoming Jewish students from abroad. Their present number is about 2,000. Some take the regular academic courses, some special programs of long or short duration. All are given every opportunity to get to know the country and the people. Quite a number have decided to remain in the country; others return from time to time.

While the Hebrew University is best equipped to receive these students, all the other universities also receive them willingly, depending on the accommodation available.

A special Steering Committee has as its objective to encourage many more Jewish students to take advantage of the various programs with the hope that in increasing numbers they will decide to remain in Israel.

Pre-academic Preparatory Courses.

In the national interest, universities have an obligation to share in the efforts of preparing suitable students for higher education in the framework of pre-academic preparatory courses. This framework provides "a second chance" for many students from underprivileged population strata, who would not otherwise have been able to study at a university. These pre-academic studies have proved their worth and should be strengthened; additional efforts are required to locate all suitable potential candidates for these studies. The possibilities for establishing additional pre-academic preparatory courses should be explored, not necessarily within the universities.

2. Conclusions Concerning the Various Fields of Study

Medicine

We now go on to discuss our conclusions and recommendations concerning specific subjects within the higher education system.

No shortage of doctors is to be expected in Israel in the foreseeable future. Medical schools in Israel have so far supplied about one third of the doctors in the health services, an additonal third being new immigrants and the remainder Israelis who have studied abroad. Despite the absorption of a number of outstanding doctors who studied abroad, both Israelis and immigrants, it may be stated that **on the average,** doctors trained in Israel are professionally superior to their colleagues from abroad and today hold most of the key medical positions in the country. Hence maintaining the high quality of medicine in Israel means ensuring that at least a minimal number of young doctors trained in Israel find their place here. Even if a serious surplus of doctors were developing we would have to give preference to the graduates of our own medical schools.

As a result of this assessment, it was agreed in 1981 by the PGC and the four medical schools in Israel that the total number of students in all schools be frozen at the present level for the next few years, and that it would not be changed without consultation with the PGC. At this stage there appears to be no reason for any such change. However the considerable drop in immigration of doctors and the danger of closure of Italian medical schools to foreign students could necessitate an updated reassessment of supply and demand forecasts for doctors in Israel. The PGC will initiate such an investigation in the next few years (see also Appendix C).

Dentistry

An examination of the country's requirements in dental hygiene pointed to a need for enlarging the schools of dentistry. The Council for Higher Education and the PGC decided to double the number of dentistry students at Tel-Aviv University and to enlarge the Hadassah and Hebrew University School of Dentistry in Jerusalem. Implementation of these decisions met with budgetary difficulties, but it is to be hoped that by 1988 the annual number of graduates from the two schools will increase by at least 50%. Such expansion is cheaper and more effective than opening an additional school. Nearer the end of the decade there may conceivably be room to consider the opening of an additional school of dentistry, first preference being given to the north of the country.

Veterinary Medicine

After a series of discussions extending over a number of years, the Council for Higher Education decided on the opening of a school of veterinary medicine within the Faculty of Agriculture in Rehovot. The first class of students at the school will apparently graduate in 1989. The school will produce at most 20 graduates a year.

Para-Medical Professions

The Ministry of Health, the General (Labor Federation) Sick Fund, the Hadassah Medical Center and the medical schools all favor gradual academization of the para-medical professions (nursing, occupational and physio-therapy). The Council for Higher Education authorized the granting of the degree of bachelor in nursing at the universities of Tel-Aviv and Jerusalem. The possibility of bringing additional schools of nursing into academic frameworks are under examination. The Council also authorized the award of academic degrees in physiotherapy at Tel-Aviv University. The Hebrew University provides academic studies in occupational therapy. The policy of the Council for Higher Education and the PGC is that all funds required for these studies should remain the responsibility of the health services or be transferred from the health services to the higher education system. The PGC sees no justification for burdening the universities with additional expenditure and relieving the Ministry of Health, the General Sick Fund and Hadassah of their budgetary responsibility for the training of manpower in the para-medical professions.

Medical Administration

On PGC initiative a committee was appointed to investigate the needs of the health services for academic manpower in the field of medical administration. The committee will in the near future present its findings to the Council for Higher Education. It may be assumed that the scope of these studies in the higher education system will be expanded.

Engineering Professions

An updated supply and demand forecast of engineering manpower in Israel's economy indicates that a balance is expected in most engineering disciplines, except for in a number of key fields. As a result, the PGC decided on the following policies over the coming five years.

Electronics and Computers

a. The fields of electronics and computers will have first priority in the higher education system. The PGC calls on the universities to expand significantly the faculties and departments dealing with these fields and to give them highest priority in budget allocations for academic and technical staff

positions, equipment and buildings. The PGC favors additional allocations for these purposes.

Aeronautical and Nuclear Engineering

b. In the fields of aeronautical and nuclear engineering there are indications of shortages, assuming that the "Lavie" airplane project on the one hand and the nuclear power station on the other are put into operation as expected. In each one of these fields the shortage results from the needs of a single national project, and there are fears of drastic fluctuations in demand. A close watch must be kept on the needs of the economy with a gradual increase in the output of the departments concerned.

Other Fields of Engineering

c. In the remaining fields of engineering the existing system, with various changes of emphasis, is capable of supplying all needs. Thus, for example, preference would be given to robotics and computer-assisted design (CAD), which are taught and researched not only in the departments of engineering and computers but also in other departments (industrial and mechanical engineering etc.). The field of electro-optics, intermediate between electronics and physics, will enjoy high priority.

In all fields having high national priority there is no lack of potential students. Shortages of buildings, equipment and posts can be overcome and all necessary funds will be made available for them. The bottleneck is the difficulty in finding suitable academic personnel for teaching electronics and computers. The possibilities of granting such personnel sufficient incentives within the framework of the established structure of salaries at universities and with the financial assistance from the electronics industry should be considered.

When and if a sufficient number of teachers are found, existing institutions will be able to absorb the numbers of students required in these fields. There is, therefore, no need for a new faculty of engineering in the coming five years. If industry in Israel should continue to develop at the present rate, then presumably by the start of the nineties, there will be room to consider the opening of an additional faculty of engineering, or the establishment of non-university institutions of higher education to train engineering personnel.

Architecture

In Israel there is one Faculty of Architecture, at the Technion. In addition there are undergraduate studies for the degree of bachelor in environmental design at the Bezalel Academy. Market

needs for architects and academic manpower in the sphere of urban, regional and rural planning must be examined. These investigations will be made in the near future.

Natural Sciences

There are faculties of science in all the universities, except for the University of Haifa, each one with sufficient academic staff and buildings to allow for the absorption of hundreds of additional students, mainly in the fields of physics and chemistry, but also in the life sciences. Only in computer science are there signs of a serious shortage of teaching personnel.

Israeli industry, the defense establishment and the educational system require additional professionals in physics and chemistry. As indicated, to absorb additional students, no further investment in universities is needed, except for investment in scientific equipment. The limitations in these fields arise from the shrinking number of high school graduates who studied physics and chemistry and are interested in continuing these subjects at a university. Action required in these fields is therefore not at university level. Those engaged in these fields in the universities must strive to advance their standing and level in high schools before a serious shortage develops, one that could seriously affect interests vital to the country.

In the field of computer science great investments are essential in computer hardware and manpower. As indicated above the PGC placed the fields of electronics and computers at the head of its list of national priorities in the higher education system and will act in accordance with this policy in all matters of budgeting.

In the life sciences there is intensive activity in study and research, mainly at the Weizmann Institute and the Hebrew University, but also at all the other institutions. All of them are alert to the changes of emphasis made necessary by latest scientific and technological developments in these fields. The PGC sees no particular need to intervene or issue directives in any form in the field of the life sciences. No particular shortages or surpluses in student numbers seem apparent in these fields.

Agriculture

No well-founded forecasts exist today concerning the demand for academic manpower in the field of agriculture. First impressions of most professionals is that the one and only Faculty of Agriculture meets all the needs of the economy for the coming few years and might even, to some extent, produce a surplus of graduates. It must, however, be remembered that in sophisticated

agriculture the percentage of university graduates must rise constantly. The PGC will initiate a study of this matter in the near future.

Humanities and Social Sciences

University graduates in the humanities (including Jewish studies and the arts) and social sciences (including managerial professions) do not necessarily engage in the specific subject in which they graduated. Bachelor degrees in these fields (and in recent years also in natural sciences) are a form of "admission ticket" to a broad range of occupations and positions requiring a general academic education. It is difficult to estimate accurately the economy's needs for graduates in the social sciences and the humanities. The present situation and general forecasts of supply and demand for academically qualified manpower indicate that a statisfactory balance exists today, which will persist over the next few years.

The PGC therefore does not plan any move in the coming few years to expand or reduce the faculties of humanities and social sciences beyond a natural growth arising from the overall increase in the number of students.

The PGC believes that for certain subjects such as management or Middle Eastern studies there is room in every Israeli university offering studies in the social sciences or the humanities. The only limitations to expanding these spheres are dictated by considerations of budget and academic standards. In these subjects there is no reason to complain of superfluous duplication.

An important topic demanding intensive consideration as the nineties approach is the structure of undergraduate studies in general and studies in social sciences and the humanities in particular. Various experiments are in progress in the western world to introduce a study program for a general B.A. degree, and for a mixed inter-faculty framework for undergraduate studies. Apart from a number of isolated instances, the pattern of study for the degree of bachelor in Israeli universities has not changed for decades. The possibilities of an exhaustive study of this subject should be considered within the universities or at inter-university level, including an analysis of the actual occupations of bachelors after graduation and the needs of the State, society and scientific research.

The PGC welcomes the gradual and slow introduction of higher degree studies in the humanities and social sciences at the young universities of Haifa and Beer-Sheba.

It is very hard to determine accurately the demand for lawyers in the economy and society. The three faculties of law existing today are able to admit only a small fraction of the applicants. The main factor limiting the absorptive capacity of existing faculties is the great difficulty in recruiting suitable academic staff. This limitation at present prevents any serious thought of establishing an additional faculty or significant expansion in existing faculties. The PGC will, however, initiate a renewed study of this matter in the next few years.

Education and Teacher Training

In the field of education, universities are training educators in a variety of fields, and primarily teachers for junior and senior high schools. Neither the Ministry of Education and Culture nor the PGC has today any clear forecasts for the near future of supply and demand of academically qualified teachers. This subject must be examined next year.

Social Work

In the field of social work the Council for Higher Education and the PGC decided not to increase in the next few years the number of students or the funds allocated to the schools for social work. In this field there are contradictory forecasts on the relation between supply and demand. After detailed discussion of this matter the PGC concluded that the present situation was satisfactory and that the number of students should be frozen at their present level for several years.

3. Infrastructure at Universities: Staff and Buildings

Academic Staff

In Chapter 2 we indicated that at the end of the seventies the student-to-teacher ratio was on the average satisfactory, crossing the "red line" somewhere at the start of the eighties. To prevent even further deterioration of the present situation, the academic staff at universities must, by 1988, grow at least as fast as the growth of the student population, i.e. 2-3% a year. In numbers this means — **some 150 new academic staff every year at all universities combined, in addition to replacement of staff resigning.** It is very hard to see how funds available to the system today can permit such growth. **We stress that this rate of growth is required just to maintain the present situation which is far from good.** In order to return by 1988 to satisfactory conditions, such as those existing at the end of the seventies, a greater increase is required. The problem is especially severe in fields in which the number of students has in recent years **grown more** than average. This applies to fields such as electronics and computers, which head the list of priorities in the system for the coming years, as well as the

social sciences, particularly management, which in recent years have been greatly in demand and have grown extensively. The increase in numbers of academic staff is not necessarily uniform in universities or faculties. There are many departments and fields where present numbers can be maintained or even reduced; however, the growth rate in expanding fields far exceeds all the "savings" which can be achieved in those not growing.

Towards the end of the eighties a rapid process of retirement of academic staff will begin. Without going into budgetary aspects, it must be pointed out that during the same period it might be difficult for universities to find researchers and teachers in sufficient numbers and of adequate standards to replace retiring staff. Even if unlimited funds were available, it cannot be assumed that Israel has more than about 200 suitable candidates a year at a desired standard to fill academic staff vacancies.

Technical and Administrative Staff

Expansion of engineering faculties also requires a significant addition of technical manpower. As for administrative staff, the ratio of students to administrative and technical staff at universities has increased over the last decade from 5.3 to 1 in 1974 to 7.7 to 1 in 1983. This is beginning to have adverse effects on standards of services at universities, in the fields of teaching and research and also in administration. Additional staff must be recruited in the next few years in order to maintain the present ratio. **A conservative estimate of the minimum number of staff required by the higher education system in 1988 will demand an additional 12% of academic staff and several percent of administrative and technical staff.**

Policy on University Staff Salaries

These figures are significant for the financial and human resources the system requires. From the financial aspect, this means an increase of over 10% in real terms of the expenditure on university salaries over the coming five years. The expression "real growth" of salaries refers not to the Consumer Price Index but to that of the average cost of workers in public employment. In recent years this cost has increased for all market sectors at a rate much faster than the Consumer Price Index. Most probably this situation will change in the next few years. In order not to affect adversely the drawing power of universities, the PGC believes that salary levels for academic, administrative and technical staff must keep pace with current conditions on the local market. As for human resources, serious difficulties are already apparent today in filling existing academic and technical positions in professions where Israeli industry and the economy are in a state of boom, real or imagined.

Thus, for instance, in electronics, computers, law, management etc., universities are finding it difficult to recruit suitable teachers prepared to devote their lives to an academic career of teaching and research. In these fields there is increasing employment of external teachers, appearing at the university for a number of hours, but making no contribution to the creation of the fruitful and inspiring atmosphere of a university. There is no harm in the use of external lecturers as long as the faculties concerned do not turn into some sort of "external faculties". We are, in a number of cases, not far removed from such a situation.

Building Program: General Outline

A building program for 1983-1988 was approved by the PGC and the Treasury at the end of 1982. The program assumes a slowing down of the rate of building at universities for these years, with emphasis on the solution of problems already exsiting today. An analysis of building floor-space at the universities indicates a number of major problems:

a. Space available to the social sciences and humanities at Tel-Aviv and Bar-Ilan Universities is far from the minimum needs of today, and can certainly not satisfy those of 1988.

b. Expansion plans for the study of electronics and computers on the one hand and dentistry on the other require additional construction at Tel-Aviv and Ben-Gurion Universities.

c. Growing student numbers at Ben-Gurion University require the building of additional student hostels.

d. The Bezalel Academy of Art and the Rubin Academy of Music in Jerusalem are suffering from difficult housing conditions.

e. The state of campus maintenance is not good, being hard hit by budget cuts.

Decisions on Building Budgets

In view of these facts, and considering additional needs in specific fields of teaching and research, the PGC discussed extensively development programs submitted by the various institutions of higher education. Principles guiding the PGC's decisions were:

a. Some new construction will be wholly financed from donations, without PGC participation. The PGC will participate in some new construction according to a fixed table of rates, intended in general to cover about one third of construction costs, and in isolated special cases up to one half.

Table 16: Buildings due for PGC Participation under Long-term Development Program by Institution

Institution	Building	Floor-space (m^2)
Hebrew University	Dentistry Wing	800
Technion	Nuclear Engineering Building	3,600
Tel-Aviv University	Science & Engineering Library	6,000
	Dentistry Building	5,100
	Central Library (additional wing)	2,500
	Electrical Engineering Building	3,500
	School of Management Building (floor)	1,500
	Management and Social Sciences Library	4,000
	Various Buildings for Humanities and Social Sciences	9,000
	Administration and Senate Building	5,500
Bar-Ilan University	Building for Jewish Studies	9,000
	Computer Center Building	1,000
	Various Buildings for Humanities and Social Sciences	16,000
	Maintenance Buildings	900
Haifa University	Central Library (expansion)	4,500
	Various Additions	2,000
Ben-Gurion University	Electrical Engineering Building	6,800
	Multi-purpose Building (floors)	2,700
	Additional Floor-space for Medicine and Natural Sciences	5,000
	Institute for Desert Research	2,500
Weizmann Institute	Biology Building (addition)	1,000
	Various Additions	1,500
Bezalel Academy	Purchase of Building and Renovation	5,500
	New Building	7,500
Other Institutions	Various Buildings	6,500

b. All construction of student hostels and social, cultural and sports amenities for staff and students is to be fully financed from donations, with no contribution from the PGC. Maintenance of these new buildings is to be covered by rent, users' fees or special endowment funds donated for this purpose. The PGC will not approve the construction of hostels or social amenities if building costs and maintenance are not fully financed from special funds earmarked for this purpose.

c. Over half the development funds available to the PGC over the coming five years will be applied to participation in the construction of new buildings for humanities and social sciences at Tel-Aviv and Bar-Ilan Universities. This construction is intended to fill urgent needs already existing today, and is not meant to permit a substantial increase in the number of students in these faculties. On the contrary, the policy of the PGC is that there should be a substantial reduction of the growth rate in these faculties. We have no intention of allocating large sums for construction in these faculties, only to find ourselves in 1988 in difficulties like those existing today. The PGC will participate in the construction of each of the buildings destined to serve these fields and approved by it, according to the lowest tariff referred to in (a) above, covering about one third of building costs.

d. The extensive building programs completed in the past at the Hebrew University, the Technion, Haifa University and the Weizmann Institute will in the coming five years permit a reduced rate of construction and in several cases an almost complete halt in building. The PGC will participate in only a small number of building projects at these institutions.

e. The departments of electrical engineering in Beer-Sheba and Tel-Aviv and the School of Dentistry in Tel-Aviv will get new buildings. These will be the only ones to the construction of which the PGC will make a larger contribution.

f. Most of the activities of the Bezalel Academy will move to an existing building on Mount Scopus and to additional premises to be erected around it. We hope a way will be found to transfer most of the activities of the Rubin Academy to the Givat Ram campus. Thus existing structures on the Hebrew University campuses will be utilized, the problems of floor-

space for the two academies will be gradually solved and ties between the Hebrew University and the academies strengthened without infringing on their academic and administrative independence.

g. The PGC will allocate annually about one fifth of its development budget for renovations and alterations on the campuses, with the object of improving maintenance of buildings and infrastructure.

h. The annual government budget required by the PGC in order to carry out these plans is about 400 million shekels (at 1983 prices); this is approximately the size of the development budget the government allocated to the higher education system in each of the past years. The Ministry of Finance has undertaken to provide these sums during the coming five years, although the amounts in fact allocated in 1983 and 1984 were somewhat lower than required.

Table 16 lists the buildings included in the program approved for construction by the PGC for the years up to 1988.

4. Research at Universities and Incentives for Excellence

Basic and Applied Research

Almost all university research budgets today are based on research grants from sources outside the university system, in Israel and abroad. Since these sources are for the most part interested in applied research projects, basic research at universities has been adversely affected. In Israel the universities alone engage in basic research on any significant scale. Hence any injury to basic research at universities will in the long run endanger the scientific and technological infrastructure of the country. It must be remembered that almost all progress, industrial, technological and military, in the country grew from seeds sown a decade or two earlier in the higher education system. The fields of computers, nuclear physics and chemistry, genetic engineering, electronics and aeronautical engineering in Israel originated in the higher education system. The science and technology of the year 2000 and the coming century must be created in our university system now; it can be assumed that they will come from the basic research whose very survival is now in danger.

Israeli Research Funds

The best way to correct this situation is by substantial increases in the research funds provided by the Israeli government to finance

basic research at the universities. The two outstanding funds in this sphere are the U.S.-Israel Bi-national Research Fund and the Fund for Basic Research. There is basic research financed from other Israeli sources; there is also extensive basic research financed from foreign sources, mainly the United States and West Germany. Their contributions aid the system, but often lead to emphases not exactly in directions of interest to Israel. Ways must be found to increase significantly basic research funds for the universities. In recent years the PGC increased considerably the Fund for Basic Research administered by the Israel Academy of Sciences and Humanities.The PGC will continue a controlled, gradual increase of this fund, but this is not sufficient.

The scope of applied research in the universities has grown considerably in recent years, and so has its contribution to industry, agriculture, defense, education and other spheres of the economy and society. A welcome dynamism has been created of application and pressures from various government sources as well as from the economy, with appropriate response on the part of the universities. We see no cause whatever for PGC intervention in this process. Financing of research projects from abroad is a welcome phenomenon from the aspect of sources of income for the universities. With that, there is a danger of a "knowledge drain", as a result of a certain predominance of the foreign financing body in the use of the knowledge acquired. Care must be taken to insist that Israel's economy has first priority for the exploitation of the knowledge created in our universities.

Scientific Equipment and Libraries

The physical infrastructure for the conduct of research in universities includes first and foremost the scientific equipment (including computers) and libraries. The PGC will in the next few years increase the amounts earmarked for these purposes in the universities. Expenditure for non-salary items in the universities has decreased by some 26% in real terms over the past decade. As a minimal target the PGC and the universities must strive for a return by 1988 to the level of expenditure, in real terms, of 1974 — that is to supply to a system with 70,000 students in 1988 the same non-salary funds available in 1974 for 48,000 students. It is hard to call this an excessive objective — let us hope we can realize it.

Competitive Funds

A major objective of the universities is the fostering of excellence in their researchers and teachers. The PGC has set up a number of funds which award grants to researchers and research teams in the universities, based on personal or team competition and excellence. First is the Yigal Allon Fellowship Fund which finances annually

some twenty new tri-annual teaching and research posts at universities. Yigal Allon Fellowships are awarded on the recommendations of selection committees which consider each candidate's qualifications on a personal basis, irrespective of institutional allegiance. At any given moment there are some 60 Allon fellows in three year cycles in the universities.

Allocations from the Fund for Scientific Equipment are also awarded by selection committees, which weigh the quality of research programs submitted by teams and researchers. These two funds, together with the Fund for Basic Research, distributed a total of over 200 million shekels in 1983, almost 2% of the budget allocated by the government to higher education. All these awards are made on a competitive basis, irrespective of institution.

External Examinations

An additional means of raising the quality of teaching and research consists of periodic examination of departments, research teams etc. by review committees from outside the institution. In other countries there are government agencies which engage in checks and surveys of this nature. The PGC's policy is not to take part in these checks but to recommend that the university administration appoint from time to time external review committees which would present their reports to the administration. A number of universities already act on these lines; we hope all the others will follow suit.

International Relations

The research establishment in Israel must compete successfully with those in the most advanced countries. This is vital both for the country's own technological and economic advancement and in order to maintain its attraction for its own citizens and for Jews of the Diaspora. An essential condition for successful competition is the maintenance of close ties with the international scientific community, with the widest possible exchange of information. This can only be kept up by frequent visits, short and long, of scientists from abroad coming to Israel and of Israelis going abroad. There is no doubt whatever that the Israeli economy and the standards of research in the universities reap considerable benefits, which can be economically evaluated, from the information "imported" by Israeli researchers working in the best research laboratories in the world. Thanks only to such close international contacts has Israel been able to maintain her position in the forefront of international science, in spite of her geographic and political isolation. International ties of the higher education system, its teachers and researchers, must be deepened and broadened.

5. Institutions of Higher Education in 1988: Appraisal of Conditions at each Institution

In preceding paragraphs we presented an overall picture and the decisions taken concerning teaching, construction, staff and research throughout the whole system. It would be appropriate to try to outline an appraisal of the situation of each one of the institutions of higher education approaching 1988. We cannot overemphasize that major developments and trends at each university must come only from within. There can be no doubt that in 1988 reality will prove that the bulk of progress in the years 1983-1988 arose from independent initiatives of the universities and not from advice or directives of some State agency. This document does not pretend to present the positions taken by the universities themselves, even though all that is said here has been extensively discussed with the university administrations. The following is an outline of the situation as seen today by the PGC, with a glance at 1988, showing the distinctive characteristics of each institution. We did not embark on a qualitative comparison of the various institutions, as we do not find that a document like the present, which deals with development trends in the system, is the place for such an evaluation.

The Hebrew University

The Hebrew University continues to occupy a central position in the higher education system. In many fields the university has the largest, best established and in some cases the only study programs. The extent of research at the Hebrew University and the number of doctoral candidates are far in excess of those in any of the other institutions.

We hope the number of students at the Hebrew University will reach about 18,500 by 1988. We shall be happy if this number is exceeded. With the completion of construction on Mount Scopus and the transfer to Givat Ram of many units scattered at present all over Jerusalem, the Hebrew University will have at its disposal the physical infrastructure to allow for such growth. University construction in Jerusalem will come almost to a complete halt. Large areas in the city will be vacated. We hope by 1988 to find the Bezalel and Rubin Academies settled into the Mount Scopus and Givat Ram campuses. There is room for limited construction at the Faculty of Agriculture in Rehovot. We do not foresee the opening of new faculties. The School for Veterinary Medicine will have opened its gates and in 1988 about three classes will be studying there. We look forward to a substantial increase in the

number of students in the faculties of natural sciences and humanities and the expansion of the School of Dentistry. Possibly an additional school for nursing will join the circle of schools under the academic responsibility of the Hebrew University. There will be no justification for any increase in administrative staff at the university. There is room for a modest increase in the academic staff, mainly in fields already overburdened today (computer sciences) or in fields which will be expanded in the future.

The Technion

The Technion was and remains the principal producer of engineers in the State of Israel. Its direct and indirect influence on technological progress in the country and the development of modern industry persists to this day.

We hope the number of students at the Technion will reach about 10,000 by 1988 and that the principal growth will be in those fields which are most in demand by Israeli industry. This will require substantial additions to academic and technical staff in those fields. We regard electronics, computers, robotics, electro-optics, aeronautical and nuclear engineering as the principal spheres in the coming decade. The Technion, as the oldest, the largest and the leading institution in these fields of engineering, must make a major contribution to the development of these fields. We hope that the hasty action of the Technion in reducing the number of students in electronics and computers in 1983 will not only be annulled in 1984, but that there will be a significant increase in their numbers. The scale of construction will be minimal and PGC participation will only be approved in isolated cases. We do not expect the establishment of new faculties at the Technion. The Technion School of Medicine must become more firmly established and promote academic activity in hospitals in the Galilee, which is a national duty of prime importance. We hope to see ever growing cooperation between the Technion and Haifa University in those few fields in which both institutions are active (mathematics, economics) as well as those with complementary activity which could lead to inter-institutional and inter-disciplinary coordination (such as between the departments of psychology and social work at Haifa University and the Medical School at the Technion).

Tel-Aviv University

Tel-Aviv University is today the largest university in Israel in the number of its students. The University has developed rapidly in recent years and invested great efforts in increasing the number of candidates for higher degrees and the scope of research conducted within its walls. Tel-Aviv University covers all major fields of

teaching and research (except agriculture) and as such represents a "small scale model" of the higher education system.

We hope that despite trends in the past and pressures from the population concentrated in the central region of the country, the rate of growth of the student body at Tel-Aviv University will decline and the University will have no more than 18,500 students in 1988. We look forward to a significant increase in the number of engineering, natural science and dentistry students, and in the number of candidates for higher degrees in all fields. We do not foresee the opening of new faculties at Tel-Aviv University. Most of the construction at the University will be devoted to solving existing problems in the social sciences and the humanities. It is essential to broaden and firmly establish the Faculty of Engineering in the major fields heading our list of priorities. This will require additional students, manpower, equipment and buildings. We see no necessity or justification for enlarging the School of Medicine (as opposed to necessary growth at the School of Dentistry), the Faculty of Social and Managerial Science or the School for Social Work.

Bar-Ilan University

The distinctive feature of Bar-Ilan University lies in its religious character and the attempts made there to stress a number of fields of study and research attuned to this feature. This is the case in fields such as Jewish studies, law, education and others. The University's rapid expansion in recent years has to some extent altered its special character.

We hope the growth rate of Bar-Ilan University will slacken and the number of students in 1988 will not exceed 10,000. The number of students in the natural sciences, the humanities and Jewish studies could increase but it would be desirable to freeze the number of students in the social sciences which today form about half the number of students at the University. We are glad that University policy on these matters coincides with the views held by the PGC.

The PGC will assist in construction on the campus in order to make conditions tolerable in the social sciences and the humanities. The University will have to raise donations on a larger scale in order to complete its share of this construction program without creating deficits in its budget. This will require the joint efforts of the University and the PGC. We do not visualize the opening of new faculties at Bar-Ilan University.

The University of Haifa

The University of Haifa was founded in order to serve the needs of the north of the country which the Technion is not in a position to fill. The University has developed in recent years and fulfills its function by relating directly and explicitly to the special problems of Haifa, the Galilee and the adjacent valleys. The University devotes special attention to development towns in the north of the country.

We hope to see some 7,200 students at Haifa University in 1988. The existing physical infrastructure can absorb such growth. The scale of construction will be modest. The major efforts of academic development at the university will be directed, as in recent years, to consolidation of existing courses and their continued progress towards the award of the degrees of master and Ph. D. The ratio of teachers to students at Haifa University must improve in the next few years. This will require an increase in the number of teachers by the recruitment of young academic staff, with particular attention to the courses leading to higher degrees. Haifa University must continue to devote itself to the service of the Galilee and the northern regions of the country and to act as the university responsible for the development of academic courses in the regional colleges of the north. With no slackening in its drive for academic excellence, Haifa University has the duty to be, in fact if not in name, the University of the North. Among other problems peculiar to the north we must recall the high proportion of the Arab population and the relatively high percentage of Arab students at Haifa University. The University must do the utmost to facilitate the absorption of Arab students in a Hebrew university framework. When discussing the Technion we mentioned that cooperation on a number of planes with the University was desirable.

Ben-Gurion University of the Negev

Ben-Gurion University has made a significant contribution to Beer-Sheba and the Negev. A major test in the next few years will be its quantitative and qualitative progress. Qualitative progress will be difficult without considerable growth of its student population and we hope to see 6,000 there in 1988. We note with special satisfaction the plan for additional student hostels financed by a generous donation and hope this will help the university to admit additional students. Main academic efforts at the University in the coming years will be directed towards consolidation of the Faculty of Humanities and Social Sciences which is about to embark on study programs for the degree of master. There is room for expansion and growth in the engineering and scientific fields already mentioned several times in the present document:

electronics, computers, robotics and nuclear engineering. The PGC will provide the resources necessary for this. We do not foresee new faculties at Ben-Gurion University. The University's welcome activities throughout the Negev must continue and grow in depth. This applies to the School of Medicine with its already enviable reputation, campus activities at Sde Boker and the two research institutes there, operation of the academic courses at the "Shaar Ha'Negev" and Eilat regional colleges, local social activities such as Perah (tutorial project) and others. The PGC will pay particular attention and give financial encouragement to the Desert Research and Ben-Gurion Heritage Institutes which operate side-by-side at Sde Boker.

The Weizmann Institute of Science

The Weizmann Institute occupies a special place in the higher education system, being a center for research and study for higher degrees in the natural sciences only. The number of candidates for the degrees of master and Ph. D. at the Institute will probably remain constant or increase slightly in the coming five years. We do not foresee additional faculties but the Institute will presumably alter directon in many fields of research and will develop various initiatives in basic as well as applied research. In recent years there has been no construction whatever at the Weizmann Institute. It may be assumed that building will recommence in the next few years, albeit on a very moderate scale. The PGC will be in a position to allocate only very modest funds for this construction and the Institute will have to seek donations.

Everyman's (Open) University

Everyman's University is a unique institution serving a large population which for reasons of location, time or lack of formal education are unable to study in the regular universities. The University was accredited by the Council for Higher Educatic: and a year ago the University awarded its first degrees. We look forward to the continued progress and consolidation of the University, which has already given proof of its high standard. We hope Everyman's University will have much to contribute to the academic courses at regional colleges, in cooperation with the universities responsible for these courses.

Non-University Institutions of Higher Education

Among major non-university institutions of higher education we include the Academy of Art and the Academy of Music and the two colleges of technology. Bezalel Academy of Art and Rubin Academy of Music continue to maintain their independent status and their unique artistic standing, while completing the process of academization. Both Bezalel and the Academy of Music have serious problems of accommodation. It has already been decided

gradually to transfer Bezalel to Mount Scopus and we hope in the near future to arrive at a positive decision concerning the gradual transfer of the Rubin Academy to Givat Ram. Both Academies wish to initiate studies for the degree of master. However, this has not as yet been authorized by the Council for Higher Education.

Jerusalem College of Technology prepares students for the degree of bachelor in three disciplines: electronics, electro-optics and computers. We have repeatedly stressed that these subjects are of prime importance to us; we hope the College will find ways to increase appreciably the number of its students and the scope of its activities in these fields. The PGC will assist the College to the best of its ability. We see no need for opening new departments in the College.

The Shenkar College of Textile Technology and Fashion makes an important contribution to the textile and fashion industry. As from 1983 the College is funded by the PGC.

Teacher Training Institutions

These institutions are funded by the Ministry of Education and Culture. Five institutions have so far been accredited by the Council for Higher Education or are in the process of academization. A special standing committee of the Council deals with the activities of these institutions. It may be assumed that by 1988 there will be up to six teacher training institutions accredited by the Council for Higher Education. At the same time the Ministry of Education and Culture announced a policy aimed at greatly reducing the number of non-academic teacher training colleges.

Regional Colleges

There are at present five regional colleges which provide academic courses for which a university is responsible. The link between the parent university and the academic courses must be strengthened and special care taken to maintain their standards. We do not expect any significant expansion of the network of academic courses over the next few years. First priority must be given to consolidating and improving those existing. We hope the problem of academic responsibilty for the Menashe Regional College will be solved and that Everyman's University will make a substantial contribution to all regional colleges. Regional colleges are funded by the Ministry of Education and Culture and various local and regional authorities.

6. The Higher Education Budget for 1988

We have already stressed the need by 1988 for a substantial increase in academic staff, a moderate increase in technical and perhaps also administrative staff and amelioration of the serious situation existing today with regard to scientific equipment, libraries and other non-salary expenditure. In order to examine the budgetary significance of these measures we present two versions.

Optimistic Version

The optimistic version makes the following assumptions:

a. An increase in the academic staff to bring it nearer to the ratio of 10 students to one teacher, regarded in the western world as desirable, and which existed in the system in 1979. In order to return to this ratio, academic staff must grow faster than the student body. As against an expected increase over 1983-1988 of 12% in the number of students, we must assume an increase of 20% in the size of the academic staff, which would be an advance towards the desired ratio without actually achieving it.

b. Increase in numbers of technical and administrative staff proportional to the increase in the number of students (that is by 12% up to 1988) and at a slower rate than the increase in the number of academic staff.

c. Increase of non-salary budget items such as computers, scientific equipment, libraries, maintenance etc. to some 30% of the total budget, regarded as desirable in the western world, and as was in fact the case in Israel until 1974.

Pessimistic Version

The pessimistic version makes the following assumptions:

a. An increase in the number of academic staff proportional to the growth of the student body, in order at least to maintain the present ratio (which is not good) of students to teachers. An increase of 12% in the number of students requires the same increase in academic staff.

b. A modest increase of technical and administrative staff (e.g. 6%). Such a small increase will cause a further significant increase in the ratio of students to technical and administrative staff.

Table 17: Budget Requirements[1] in 1988 for Higher Education System

	1983	1988	
		Optimistic Version[2]	Pessimistic Version[3]
Total Budget	100.0	134.3	115.1
Academic Staff Salaries	55.0	66.0	61.6
Administrative and Technical Staff Salaries	25.0	28.0	26.5
Non-Salary Expenditure	20.0	40.3	27.0
Annual Real Growth (percent)	—	6.0%	2.9%

1 All budgets calculated on a base of 100 units of ordinary budget in 1983, deducting the effect of change in the Consumer Price Index. We assumed that wages in the market (and in universities) vary according to the Consumer Price Index.

2 **Optimistic Version:** Academic staff reverts to student:teacher ratio of 1981; administrative and technical staff grows according to increase in student numbers; non-salary expenditure reaches 30% of total budget.

3 **Pessimistic Version:** Academic staff grows according to student numbers; administrative staff grows 6% in period investigated; non-salary expenses revert to their real value in 1974.

c. Increase in non-salary expenditure, at least up to its value in real terms in 1974, irrespective of the fact that from that year until 1988 the number of students will have grown from 48,000 to 70,000.

In the opinion of many, the three assumptions made in the pessimistic version are far below the minimum required for proper functioning of the higher education system. All are agreed that fulfillment of requirements proposed in the pessimistic version will allow no margin for flexibility, safety or comfort.

To convert the optimistic and the pessimistic verisons into budgetary terms and estimate the funds required for the higher education system in 1988 we must evaluate the various components in relation to the Consumer Price Index.

Today some 55% of the budget is devoted to academic staff salaries, some 25% to technical and administrative staff and some 20% to non-salary expenditure.

We assume that the non-salary expenditure will vary roughly in accordance with the Index. Salaries of university employees will change according to changes in mean wages in the economy.

As our first exercise let us assume that wages on the local market for the next five years will be linked to the Consumer Price Index, in keeping with the government policy of maintaining wages at their real value.

Funds needed for the system under this assumption and according to the two versions are given in Table 17.

The table shows that if real wages are maintained, the higher education system will need an average annual budget increase of 3% or 6% respectively for the two versions.

In recent years average wages rose faster than the Consumer Price Index. According to publications of the Central Bureau of Statistics real wages went up some 35% over the past decade. Costs to employers rose much faster owing to the increase in tax and insurance rates payable by them. To examine the possible outcome of similar behavior over the coming five years we also tested an alternative assumption for the behavior of wages. As a "maximal" assumption we took an annual increase in wages of 3% in real terms. The funds needed for the higher education system in 1988 under this assumption would require an annual mean real increase of 5.2% for our pessimistic version and of 8.3% for the optimistic one.

Sources of Income

What are the sources of income expected over the next few years?

We assume there will be no far-reaching changes in the relative share of the various components of university income. According to the "Katsav Committee's" decisions, tuition fees will remain linked to the index for the next five years. There is no reason to believe the relative proportions of donations or of income from research grants will change significantly in the coming years. Some increase of income might be expected from endowment funds and perhaps from the sale of services.

Hopefully the increase in income from non-government sources will allow the proportional share of these sources in university income to be maintained. Hence the government will have to continue to allocate to the universities at least its present share of their budgets. This will require a real increase of 3% to 8%

annually in the State budget devoted to higher education according to the different alternatives.

If in the next few years economic growth is resumed, we expect the country will be able to bear this burden.

In any other circumstances the State will have two alternatives:

a. To cause serious damage to the higher education system. Without trying to sound overly pessimistic we cannot refrain from describing the inevitable injury to the system should the government prove unable to meet at least the rate of budget increase needed for our "pessimistic version". In such an event universities will have to restrict progressively the number of students admitted to the faculties and courses in demand. The number of students will not reach 70,000.

   Thousands of recipients of matriculation certificates each year will not be admitted to the higher education system, with the resulting harm to the social fabric of the country. We fear that such a situation might well on the one hand cause an increase in the number of Israelis studying abroad (and not always returning), and on the other hand prejudice efforts to bring broad strata of the population into the academic system. There is no doubt that restriction on student numbers and raising the admission threshold will in the main affect adversely students of the pre-academic preparatory courses and high school graduates from regions where secondary education is less well established. In our opinion the State and government cannot reconcile themselves to such a situation. Failure to implement even the pessimistic version will badly affect scientific research and especially basic research which is carried out almost entirely at universities. Such damage is already in evidence today, and should it become more severe, will seriously harm industry, agriculture and the defense establishment from the beginning of the nineties. It would be easy to depict an even more serious scenario but we refrain from doing so in order not to terrify ourselves.

b. If economic growth is not resumed and if we wish to prevent serious damage there will be no alternative but to increase the relative share of higher education in the State budget. The necessary increase will then restore higher education to its position in the latter half of the seventies, a burden the country should be able to support even if not easily.

The Situation in 1984

Following events connected with salaries of academic staff during the current year and government decisions on budget cuts in 1983, it is already clear that government funds made available to the universities in 1984 will be less in real terms than in 1983. This situation clearly conflicts with all the forecasts and assumptions we presented in this chapter. Such regression in budgeting necessitates even more an increase in real terms in the budget for higher education in the coming years. It must here be emphasized that the **minimal** increase in real terms needed in each one of the remaining four years until 1988 is likely to reach about 5% (instead of 3%) as a result of the cuts imposed on the system for 1984.

Chapter 5: First Glance at 1995

So far we have engaged mainly in describing the general situation predicted for 1988 and what may be deduced from it with regard to programs for the physical and academic development of the higher education system. We cannot refrain from a hurried glance and first look into the more remote future. We chose the year 1995 as target year of this glance.

Students in 1995

The number of students in 1995 will be about 85,000, assuming that the policy of the Ministry of Education and Culture concerning matriculation certificates remains unchanged and, as is the case today, almost all holders of a matriculation certificate will take up academic studies. This figure is about one third more than the number of students today. The number of students could possibly be even greater should the present tendency of the older population to return to academic studies continue.

Increase in the Number of Older Students

The western world is advancing towards extremely meaningful social changes, all of them having a bearing on the number of students in the higher education system. The rate of technological and scientific innovations necessitates a comprehensive and expanding system of complementary academic courses for engineers, teachers, doctors, managers and many other professions.

In the nineties there will most probably be a substantial increase in the number of older students engaging in "a second round" of studies, not all of them necessarily interested in additional academic degrees. This would demand structural changes in study programs and expansion of the scope of university activities beyond that indicated by the numbers matriculating.

Extension of the mean lifespan and relative growth in the number of pensioners have in recent years created additional sectors of the population interested in academic studies. The gradual process of growing leisuretime of the older population is also likely to lead to greater demand for academic studies.

All these factors lead to the same phenomena: numbers of students in excess of those expected from matriculation forecasts; an increase in the number of students in special programs, diploma and external studies etc.; an increase in the relative proportion of students taking part-time study programs. It is hard to evaluate the cumulative weight of all these trends. Possibly by the mid-nineties they will have an important effect on the structure and scope of the higher education system of Israel.

Expansion of Existing Institutions or New Institutions

In order to be able to admit the students of 1995 we shall have to take one or more of the following steps:

a. To expand existing universities by about one third. This would mean that two universities will have a student population of 22,000 each. The other universities will also grow proportionally. There are campuses much larger than this abroad, but that does not necessarily make them desirable. In any case this would require large scale investments in additional buildings.

b. To found one or more new universities. The greatest demand for higher education will unfortunately be in the central region and the most urgent need around Tel-Aviv. A university in the Galilee will not solve the problem even if that region were to develop beyond all expectations and forecasts.

c. To enlarge substantially the non-university institutions of higher education, including the academic courses in regional colleges, and perhaps consider founding a college for which an existing university would have academic responsibility.

Exhaustive discussions of these alternatives must be held over the next few years within the higher education system. Appropriate decisions of principle must be taken in the mid-eighties to allow for the planning and construction of the infrastructure in time for the nineties. If clear-cut decisions are not taken, the system will unintentionally find itself in the situation described in the first alternative above. With that, it may be assumed that some time in the nineties the need will arise for new institutions and it would be best for the matter to be thoroughly examined before any decisions are taken.

Emphasis on Science and Technology

If the Israeli economy succeeds in consolidating its sophisticated industrial infrastructure and if, as we hope, it bases itself on products entailing advanced know-how, then this will necessitate

a change of emphasis towards scientific and technological professions. There is, on the other hand, no need to go to extremes and neglect the infrastructure — pedagogic (training teachers and educational personnel); social (for doctors and social workers), and cultural, Jewish and general.

New Faculties

Presumably towards the nineties there will be room for new faculties (engineering in Jerusalem? law at Haifa or Beer-Sheba? dentistry at the Technion or Beer-Sheba?). There will also possibly be room for additional specialized non-university institutions of higher education in particular fields of art or technology. These decisions can be postponed until or close to 1988.

Structure of Undergraduate Studies

An additional matter demanding attention in the next few years is the structure of university studies, and in particular undergraduate studies. Here a number of interrelated matters are involved: should the frameworks of general and inter-disciplinary studies be broadened? Will there be a continuation of the gradual process whereby the degree of bachelor represents "general education", at one and the same time an extension and deepening of secondary education and a preparation for more advanced professional studies, as in the United States? Will teaching methods at universities change with the introduction of new technologies? Can a situation continue in which students of the natural sciences do not in general study any subjects in the humanities and social sciences, while students of the humanities, social sciences and law in general complete their studies without any aquaintance whatever with scientific and technological subjects? Should the length of undergraduate studies be altered? Decisions on these subjects will not only affect everything connected with study programs and the teaching staff required, but will also have implications for budgets and policy concerning the physical development of the system.

The Difficulty in Recruiting Suitable Academic Staff

One of the most worrisome problems towards the mid-nineties will be the need for accelerated replacement of academic staff in the universities. A considerable part of the scientific and academic elite in the universities is due to retire in the early nineties. In addition to the quantitative necessity for recruitment of a large number of university teachers, there is also the qualitative difficulty of finding a sufficient number of young candidates who meet the qualitative requirements and are capable of maintaining and even raising academic standards. Serious consideration should be given to the possibility of starting gradual recruitment of the new young staff required a number of years before the great wave of retirement takes place.

Scientific and Technologic Infrastructure

Beyond any centralized planning activities, and beyond all State direction there is an added challenge, perhaps the main challenge, facing universities as we approach 1995.

Today, (if not yesterday) is the time to sow all those seeds in the fields of science, technology, medicine and agriculture which in 1995 will grow into an economic and security structure making proper and up-to-date use of the best of human knowledge available in all these fields. Experience has shown that such seeds are most often sown by local initiatives, by "fanatics" and by isolated individuals with vision inside the various institutions. All that is required of the heads of universities, the Council for Higher Education and the PGC is to find ways to encourage these initiatives. The higher education system in Israel has successfully stood up to such tests throughout its existence. Let us hope this will continue to be so in the future.

Appendices

Appendix A: Budget Details for 1981-1982
Appendix B: Geographic Considerations in the Higher Education System
Appendix C: Forecast of Supply and Demand for Doctors of Medicine
Appendix D: Forecasts of Supply and Demand for Engineering and Technological Manpower

Table A-1: Ordinary Budget of Higher Education System for 1981 and 1982
(in millions of shekels at current prices)

Budget Item	1981					1982				
	Total Budget Expenditure	Income				Total Budget Expenditure	Income			
		Direct PGC Allocation	Tuition Fees	Donations	Other Sources		Direct PGC Allocation[1]	Tuition Fees	Donations	Other Sources
Total	**3,394.1**	**2,555.8**	**132.8**	**245.2**	**460.3**	**6,607.7**	**4,699.2**	**272.4**	**504.5**	**1,131.6**
Universities	2,931.5	2,172.0	129.0	241.7	388.8	5,732.8	4,046.9	265.2	496.4	924.3
Other Institutions	57.0	45.4	3.8	3.5	4.3	113.7	91.2	7.2	8.1	7.2
Sundry Items	400.0	332.8	-	-	67.2	750.0	549.9	-	-	200.1
PGC Administration	5.6	5.6	-	-	-	11.2	11.2	-	-	-

1 Includes salary differentials paid on account of preceding years.

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Table A-2: Ordinary Budget of Universities for 1981 and 1982
(in millions of shekels at current prices)

Institution	1981					1982[1]				
	Total Budget Expenditure	Direct PGC Allocation	Other Income			Total Budget Expenditure	Direct PGC Allocation	Other Income		
			Tuition Fees	Donations	Other Sources			Tuition Fees	Donations	Other Sources
Total	**2,931.5**	**2,172.8**	**129.0**	**241.7**	**388.8**	**5,732.8**	**4,046.9**	**265.2**	**496.4**	**924.3**
Hebrew University	779.5	592.5	28.0	71.1	87.9	1,582.0	1,100.6	54.9	136.0	290.5
Technion	487.7	384.7	21.7	37.6	43.7	951.9	710.0	40.5	108.0	93.4
Tel-Aviv University	625.5	499.5	37.5	9.0	79.5	1,197.0	915.5	76.4	16.0	181.1
Bar-Ilan University	239.8	178.8	14.2	19.3	27.5	458.7	341.5	35.7	21.0	60.5
Haifa University	161.5	123.5	12.9	4.2	20.9	312.8	220.0	26.5	17.2	49.1
Ben-Gurion University	220.5	181.0	6.5	23.5	9.5	451.1	350.0	13.7	57.8	29.6
Weizmann Institute	359.5	178.5	-	86.2	114.8	659.0	340.0	-	119.5	199.5
Everyman's University	57.5	33.5	8.2	10.8	5.0	120.3	69.3	17.5	20.9	12.6

1 Approved budget, not updated, does not incorporate latest wage agreements.

Table A-3: Ordinary Budget of Other Institutions of Higher Education for 1981 and 1982
(in millions of shekels at current prices)

Institution	1981					1982				
	Total Budget Expenditure	Income				Total Budget Expenditure	Income			
		Direct PGC Allocation[1]	Tuition Fees	Donations	Other Sources		Direct PGC Allocation	Tuition Fees	Donations	Other Sources
Total	**57.0**	**45.4**	**3.8**	**3.5**	**4.3**	**113.7**	**91.2**	**7.2**	**8.1**	**7.2**
Bezalel Academy of Art	30.6	27.3	1.5	1.0	0.8	61.5	55.0	3.0	2.1	1.4
Rubin Academy of Music	12.6	10.1	1.0	0.5	1.0	24.8	21.1	2.0	1.0	0.7
Jerusalem College of Technology	11.2	7.3	0.5	2.0	1.4	22.9	13.8	1.0	5.0	3.1
Ruppin Institute of Agriculture[2]	2.6	0.7	0.8	-	1.1	4.5	1.3	1.2	-	2.0

1 Includes salary differentials paid on account of preceding years.
2 Only the academic course.

Table A-4: University Development Budgets in 1981 and 1982 (in thousands of shekels at current prices)

Institution	1981		1982	
	Actual Investment[1]	PGC Participation	Estimated Investment	PGC Participation
Total	**393,400**	**84,266**	**730,000**	**180,692**
Hebrew University-Total	132,900	17,250	250,000	180,670
of this: Mt. Scopus[2]	122,600	14,250[4]	240,000	27,670[4]
Technion	120,000[3]	35,000	160,000	76,000
Tel-Aviv University	85,000	14,000	135,000	34,000
Bar-Ilan University	11,400	3,000	45,000	20,000
Haifa University	1,900	750	15,000	2,000
Ben-Gurion University of the Negev—total	29,500	10,700	85,000	15,000
-of this: Desert Research Institute[2]	2,400	700	4,000	2,000
Weizmann Institute of Science	12,700	1,900	40,000	5,000
Special Allocations for Energy Conservation	-	1,666	-	1,022

Remarks:

1 Source of Data: Universities' financial reports, incl. construction, installations and furniture in new buildings.

2 Defined as a Special National Project.

3 After deducting estimates of uncompleted parts of signed contracts.

4 Including payments from outside of budget.

Appendix B: Geographic Considerations in the Higher Education System

For the purpose of planning the higher education system it is interesting to analyse connections between the students' place of permanent residence and the tendency to continue with higher education, and also the choice of place of study.

Geographic Differences in Approach to Higher Education

The first point of interest is the distribution by region of students' permanent **residence** compared with that of the whole population. Data presented below indicate regional percentage distribution in 1978. From these it can be seen that the tendency toward higher education is comparatively high among inhabitants of Haifa and Tel-Aviv and relatively low among those in the southern and central regions.

It should be pointed out that compared with previous years (the earliest figures are for 1965) there has been an appreciable rise in the tendency toward higher education among the population in the northern and southern regions resulting probably from the founding of Haifa and Ben-Gurion Universities. As for the geographic differences in relation to the tendency toward higher education, a number of phenomena may be mentioned:

a. Inhabitants of the Haifa region are inclined more than others to study engineering; while engineering students are some 16% of the total student population, the ratio of those coming from Haifa is 28%. As a result some 34% of engineering students are from Haifa, though they are only 20% of the whole student body.

b. Inhabitants of rural settlements are more inclined than others to study agriculture, some 47% of students of agriculture coming from rural areas while they are only about 10% of the whole student body.

c. Inhabitants of Jersualem tend more than others to study the humanities, and the social sciences less than others. Whereas some 30% of all students study humanities and 30% social sciences, for Jerusalemites the ratios are 43% and 22%, respectively.

   In addition, among Jerusalemites the inclination to study natural sciences is greater than that of other students: some

Table B-1: Distribution of Student Population at Universities compared with Whole Population Distribution, by Region of Residence 1978

Region of Residence	Distribution of Whole Population[1]	Distribution of Jewish Population[1]	Distribution of Jewish Population Age 20-29[1]	Distribution of Student Population[2]
Northern Region	15.4	9.4	9.8	9.5
Haifa Region	14.7	14.4	13.4	20.8
Central Region	19.8	21.8	22.4	15.6
Tel-Aviv Region	26.4	31.1	28.9	35.0
Jerusalem Region	11.4	10.0	10.9	11.2
Southern Region	11.9	13.0	13.6	7.9
Total	**100.0**	**100.0**	**100.0**	**100.0**

1 Source of data: Central Bureau of Statistics

2 Source of data is a student census in which students were asked to state their place of permanent residence (by their own understanding and definition). The data appear in Tables 17-19 in Publication No. 699 "Students at Universities: Studies, Occupation and Sources of Income—1978" of the Central Bureau of Statistics.

Table B-2: Proportion of Students at Universities Permanently Resident in the Same Region as the Institution of Study

Years	All Students	Hebrew University	Technion	Tel-Aviv University[1]	Bar-Ilan University[1]	Haifa University	Ben-Gurion University
1966	59.8	38.3	41.9	90.5	83.6	84.9	...
1968	61.1	38.9	42.9	91.2	83.1	78.6	41.8
1970	61.1	38.4	43.6	89.7	84.0	76.2	47.6
1972	62.3	43.3	42.9	88.1	82.7	73.8	45.6
1974	62.4	41.4	46.5	87.4	83.2	71.5	48.1
1978	65.0	43.1	49.8	86.0	82.7	70.7	43.7

1 For Tel-Aviv and Bar-Ilan Universities the percentages include those living in the Tel-Aviv as well as the whole Central region, extending from Netanya to Rehovoth.

Table B-3: Comparison of Student Distribution at Universities by Region of Permanent Residence and Place of Study

Year		Total	Northern Region	Haifa Region	Central Region	Tel-Aviv Region	Jerusalem Region	Southern Region
1966	-Perm. Residence	100.0	4.6	19.9	14.5	43.4	15.1	2.5
	-Study	100.0	-	24.8	36.3		38.9	-
1970	-Perm Residence	100.0	5.6	21.1	14.7	40.8	13.0	4.8
	-Study	100.0	-	25.5	37.0		33.8	3.8
1974	-Perm. Residence	100.0	6.6	18.4	16.2	37.6	14.4	6.8
	-Study	100.0	-	22.1	39.8		31.1	6.9
1978	-Perm. Residence	100.0	9.5	20.8	15.6	35.0	11.2	7.9
	-Study	100.0	-	25.9	42.3		24.2	7.7

20% of students from Jerusalem study science compared with 13% of all students; hence 17% of science students as compared with 11% of all students, come from Jerusalem.

d. Inhabitants of the Tel-Aviv region form a comparatively large proportion of students of the social sciences and law: some 44% from the Tel-Aviv region, as compared with an overall ratio of about 33%.

Choice of Place of Study

As for the tendency to study in an institution located close to the place of residence, this can be seen from the following data, giving the percentage of students whose permanent residence is in the same region as the institution in which they study, as against the total number of students at that institution. We have a series of figures from 1966 to 1978, from which it may be seen that there are institutions with a more local character, that is a high proportion of the students coming from the neighboring population, while others have a more national character, that is with large numbers of students coming from outside their immediate neighborhood. It is interesting that among the whole student body there is over this period an increasing tendency to choose an institution of study near their place of residence. As for the difference between institutions: we find a decline in the "national" nature of the veteran institutions — the Hebrew University and the Technion. Ben-Gurion University possesses a "national" character with more than half its students coming from outside the southern region. At Tel-Aviv and Bar-Ilan Universities most of the students are from the Tel-Aviv and central regions, with a slight tendency to an incease in the proportion of those coming from other regions. At Haifa University the proportion of those from outside the Haifa region has risen appreciably.

As a result of this development we find over the period the following changes in the distribution of students by their place of origin, as compared with their distribution by place of study.

Outstanding trends in the tendencies dominant over the past 15 years are: an increase in the proportion of students at universities in the center of the country (Tel-Aviv and Bar-Ilan Universities) as well as at the southern university in Beer-Sheba, as opposed to a decline in the proportion of students at the Hebrew University in Jerusalem and stability in the "northern" universities.

Plans for the Future

Plans for the future concerning the distribution of students among the different universities should allow not only for the tendency dominant during recent years but also and primarily for the government policy of population dispersal.

This policy may be summed up as aimed at increasing the share of peripheral regions — the north, the south and Jerusalem — and reducing that of Tel-Aviv and the central regions. Numerically speaking the objective is a reduction over the coming ten years of the share in the total population of the central and Tel-Aviv regions from 46% to 42% and among the Jewish population from 53% to 47%, and to increase the share of the Jewish population in the Jerusalem region from 10% to 12%, in the northern region from 10% to 11% and in the southern region from 13% to 14%.

Since this policy is in opposition to actual natural forces, its fulfillment involves measures of policy aimed at restraining growth in the Tel-Aviv and central regions, both regarding places of employment, development, services etc., and encouraging expansion in the peripheral regions.

Thus implementation of this policy in the development of higher education requires restrictions on the growth of Tel-Aviv and Bar-Ilan Universities, and the encouragement of development at the Hebrew University and Ben-Gurion University, as well as the Technion and Haifa University, insofar as these institutions are considered as serving the population of the Haifa region as well as the north of the country.

From the aspect of achieving the policy of population dispersal, the development of universities does not only mean attracting students, but also building focal points of attraction for academic and other staff, centers of scientific and cultural activity and the development of places of employment supplying services to all the population connected with the universities.

Appendix C: Forecast of Supply and Demand for Doctors of Medicine

The last forecast of supply and demand for doctors was made in 1981 by the Economic Planning Authority, which examined the supply and demand for doctors in 1980-1989.

In the past a number of investigations of this type were made, such as those of Prof. Michael Feldman and Prof. Rafael Trifon, and other investigations by the Economic Planning Authority.

Results of most of the preceding work indicated similar trends — a surplus of doctors toward the end of the seventies and the beginning of the eighties. The fact that in the early eighties we are not aware of a large surplus of doctors is largely due to two factors:

a. Recognition of the fact of present and expected surpluses produced pressures to expand the health services (national expenditure on health grew in real terms by 71% during the seventies) at a rate greater than was foreseen. One consequence of the growing supply of doctors found expression in work agreements. In the years 1974, 1976 and 1978 the doctors' work agreements provided an increase in the number of postions for doctors, hundreds of posts in the Ministry of Health, the General Sick Fund and the large public hospitals. In 1979 the number of actively employed doctors was estimated at 10,200 compared with 6,900 in 1974, i.e. during those five years the number of doctors increased by 48%, an annual growth of 8%.

b. The actual supply was a little less than the potential supply. Immigration and return of Israelis from abroad was less than assumed at the start of the seventies and emigration was possibly larger.

The latest project tested the supply and demand for doctors for 1980-1989. Findings of the project showed that a substantial surplus of doctors could be expected in the eighties.

A forecast of demand for doctors was made from an overall view of the national economy, based on limitation on the scope of services the country could support, allowing a maximum expansion in health services of 2-3 percent a year.

No massive expansion of health services like that of the seventies

was assumed, nor the demand for doctors which accompanied it, this being a direct outcome of the state of the national economy.

On the face of it, the expansion of the health services and the employment of doctors beyond the level indicated above should have been possible. The employment of larger numbers of doctors would have "solved" the surplus of doctors, based on the economic concept that the alternative cost of these same doctors is close to zero.

The real situation is in fact more complex and the above conclusion is wrong. Expansion of health services in order to create employment for doctors of necessity means increased demand for additional manpower in these services: nurses, X-ray technicians, physiotherapists, pharmacists and administrative and maintenance staff, of whom there is no surplus; all this apart from large investments in medical infrastructure and current expenditure. Furthermore, such growth of the institutional structure in Israel is linked to public investment and expenditure, or requires considerably increased expenditure of households in Israel, who already have to increase their participation for existing costs of health care.

Table C-1: Forecasts of Total Additional Supply and Demand for Doctors, 1980-1989, for Various Alternative Situations.

	1980-1984	1985-1989	1980-1989
Additional Supply (net)			
Alternative A	2,800	2,700	5,500
Alternative B	2,570	2,410	4,980
Alternative C	2,450	2,250	4,700
Alternative D	2,220	1,960	4,180
Additional Demand			
Alternative A	1,740	1,760	3,500
Alternative B	1,470	1,510	2,980
Alternative C	1,410	1,350	2,760
Alternative D	1,100	990	2,090

Source: "Supply and Demand for Doctors 1980-1989", Ministry of Finance Economic Advisory and Planning Authority, October 1980.

The forecast of demand was compiled in several alternative ways, differing mainly in emphasized lines of development in the medical establishment. The forecast shows a minimum demand for additional doctors estimated at about 2,100 over the decade (in case of comparatively substantial savings in the field of ambulatory services) and a maximum of some 3,500 additional doctors.

Additional supply was also estimated for a number of alternative cases, all sharing a low estimate of immigrant doctors compared with the seventies, so that in every case the supply forecast should be taken as a lower limit. The lowest estimate of additional supply over the decade is about 4,200 doctors and the highest addition about 5,500. This means a minimum annual growth of 3.5% and a maximum of 4.4%. It follows that even if we set the highest increase in demand against the lowest increase of supply there is a surplus of some 700 doctors over the period of the forecast. A more practical and consistent comparison would be between the lowest supply estimates for doctors and the most moderate demand foreseen. In that case the surplus of doctors expected over 1980-1989 is estimated at about 2,000.

Another comparison between the growing demand for doctors and the largest additional number available also indicates a difference of about 2,000 doctors.

In principle it is also feasible to compare combinations of lower demand and higher supply, which would result in a much larger surplus, amounting to over 3,000 doctors.

For the relevant comparisons the clear conclusion is that a surplus of doctors is expected in each year covered by the forecast. This surplus has been estimated as about 13%-18% of the potential number of doctors by the end of the eighties.

The surplus of doctors is not easy to resolve immediately and any proposal must consider the following factors:

—The period of study for the medical profession is long and in fact most of the future Israeli trained doctors until the end of the eighties are today already at various stages of their studies.
—It is almost impossible to retrain doctors for other professions. Doctors not finding employment in the medical profession in Israel naturally seek alternative employment abroad.
—Planning the supply of doctors is difficult because of the important part played by immigration and returning Israelis.

—The quality of medical training varies according to the different sources.

A considerable reduction in local graduates, due to the reliance on the availability of immigrant and returning Israeli doctors, is liable to affect adversely the future quality of medicine in Israel, on the generally accepted assumption that graduates of Israeli medical schools form a high quality cadre capable of leading the medical establishment to high achievements.

Appendix D: Supply and Demand Forecasts of Engineering and Technological Manpower

In 1983 David Brodet, economic adviser to the Ministry of Industry and Trade, drew up a forecast of engineering manpower supply and demand for the economy over the coming decade. His principal conclusions are given below.

Planning the needs of the engineering and technological workforce for the coming years is based on two main factors — first, the needs of the economy and especially of industry, and second, the supply of manpower and demographic development trends and educational standards in Israeli society.

Table D-1: Supply and Demand Forecast for Engineers, Practical Engineers and Technicians 1983-1992

a. Forecast for Engineers.

Total Additional Demand (net)	**17,500**
In Industry[1]	9,500
Elsewhere in Economy	8,000
Total Additional Supply (net)[2]	**12,100**
Shortage	5,400

b. Forecast for Practical Engineers and Technicians

Total Additional Demand (net)	**29,000**
In Industry[1]	16,000
Elsewhere in Economy	13,000
Total Additional Supply (net)	**21,000**
Shortage	8,000

1 Assuming average growth in "sophisticated" industries of 18%.

2 Assuming annual immigration to Israel of about 700 engineers (meeting professional criteria acceptable in Israel).

Findings presented below are based on a full and comprehensive set of assumptions. The forecast presented was prepared in only one version, but sensitivity to various parameters was examined. Tests show that in fact the parameter with the greatest sensitivity and influences in the forecast is the number of immigrant engineers. In the seventies immigrant engineers provided the major supply of manpower at these levels. The following forecast is based on the assumption that the annual number of immigrant engineers will not reach the same levels as in the seventies but will be higher than in the years 1980-82.

The demand side of the forecast for engineering and technological manpower was based on a program projecting the needs of Israel's balance of payments and in particular on planning for industrial development aimed at the expansion of sophisticated export branches.

The principal findings indicate engineering manpower shortages at all levels and the need for comprehensive reorganization in order to train sufficient technological and engineering manpower (engineers, practical (non-academic) engineers and technicians) in order to meet major challenges facing Israel's economy and industry.

The purpose of the forecast was to show the imbalance expected between engineers and practical (non-academic) engineers. Under normal circumstances there would be a certain significance to the flexibility of exchange between these two professions. However, in the future this flexibility will no longer be practical. There is a need for greater activity to maintain the momentum, begun in recent years,to achieve the objectives of Israeli society and economy.

The policy necessary in order to meet engineering manpower requirements must operate over various timespans, particularly in view of the fact that suitable reserves must already be prepared at the stage of initial planning.

In the immediate future, during 1983 -87, every effort must be made to bring back Israelis from abroad and increase immigration to Israel. At the same time, the numbers studying these professions in Israel should be increased, and action taken to attract potential students and to ensure that the institutions get the necessary means for technical training at the various levels of proficiency. Simultaneously, action is also needed in the elementary and

secondary schools to advance and consolidate technological education and widen the circle of those learning technological and engineering subjects; all this can help solve the basic problem of the Israeli economy namely,attaining economic independence.

Principal Findings

1. Planned and foreseen developments indicate a continuing trend in development of the Israeli economy and in particular its industry toward production using high -grade technology and know-how, which in turn will generate a great demand for all grades of manpower trained in engineering technology.
2. The expected demand for engineers in 1992 is estimated at about 45,000, 20,000 of them in industry, compared with some 27,000 employed in 1982, of whom 10,000 are in industry. Hence additional demand for engineers over the decade 1982-1992 will be for about 18,000, 10,000 of them in industry. The proportion of engineers in the economy will be 2.8% by 1992, and 5% in industry as compared with 2.1% and 3.2% respectively in 1982.
3. The supply of engineers expected from all sources over the years 1983-1992 has been estimated at about 13,000, that is, according to forecasts, an expected shortage of some 5,000 engineers, mainly in the second half of the eighties.
4. Demand for practical (non-academic) engineers and technicians in 1990 will reach 63,000, of these some 20,000 for industry, i.e. the demand for additional practical engineers and technicians will be 29,000 over the years 1983-1990. In this case the percentage of practical engineers and technicians will be 4% of the working force, and 7.5% in industry. The ratio of practical engineers and technicians to engineers will be 4:1 and 5:1 respectively in the latter half of the decade.
5. In these years the expected supply of practical engineers and technicians will be about 21,000, i.e. an expected shortage of some 8,000 practical engineers and technicians, mainly in the latter half the eighties.
6. The main shortage expected will be felt mostly in the following engineering fields: computers, programing and electronics. The annual demand in these fields is estimated at about 800-1,000 engineers and some 1,200-1,400 practical engineers and technicians.
7. A shortage of technological engineering manpower at the different levels will slow down industrial and economic development and prevent the realization of large national projects. In this lies a danger of long-range damage to the

technological image of Israel and the directions of industrial growth over the coming years.

8. The demand for engineering manpower also includes the special requirements arising from the relatively heavy burden of defense. The defense establishment with its variour branches employs a relatively large number of scientists, engineers and other technological manpower in order to maintain the high quality of Israel's defense capability. This means that compared with other countries in the world at a similar level of economic development, Israel's economy, in particular Israel's industry and its defense sector, must reach a higher relative rate of employment of technological and engineering manpower than such other countries. Since Israel's economic needs prescribe rapid economic development equalling levels of developed countries, the demand for technological manpower will in consequence be extremely high in coming years.
9. A characteristic of sophisticated industries is the number of engineers, practical engineers and technicians reaching over 30% of the total workforce. There are enterprises in which this percentage is even higher.
10. In recent years, most additional workers in Israeli industry were concentrated in the high-technology and sophisticated branches, their principal feature being the qualitative growth of technological manpower. In the last decade, those in the technological occupations — engineers, practical engineers and technicians — made up some 30% of all additional workers in the branch.